2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Grade K Alabama Course of Study Standard**	**Grade 4 NAEP Content Statements**
K.1	Investigate the resulting motion of objects when forces of different strengths and directions act upon them (e.g., object being pushed, object being pulled, two objects colliding).	**P4.13**-An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far. **P4.14**-The motion of objects can be changed by pushing or pulling. The size of the change is related to the size of the force (push or pull) and the weight (mass) of the object on which the force is exerted. When an object does not move in response to a push or a pull, it is because another push or pull (friction) is being applied by the environment.
K.2	Use observations and data from investigations to determine if a design solution (e.g., designing a ramp to increase the speed of an object in order to move a stationary object) solves the problem of using force to change the speed or direction of an object.*	**P4.13**-An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far. **P4.14**-The motion of objects can be changed by pushing or pulling. The size of the change is related to the size of the force (push or pull) and the weight (mass) of the object on which the force is exerted. When an object does not move in response to a push or a pull, it is because another push or pull (friction) is being applied by the environment.
K.3	Distinguish between living and nonliving things and verify what living things need to survive (e.g., animals needing food, water, and air; plants needing nutrients, water, sunlight, and air).	**L4.1**-Organisms need food, water, and air; a way to dispose of waste; and an environment in which they can live.* **L4.2**-Organisms have basic needs. Animals require air, water, and a source of energy and building material for growth and repair. Plants also require light. **L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations. **E4.5**-Natural materials have different properties that sustain plant and animal life. **E4.7**-The Sun warms the land, air, and water and helps plants grow.

K.4	Gather evidence to support how plants and animals provide for their needs by altering their environment (e.g., tree roots breaking a sidewalk to provide space, red fox burrowing to create a den to raise young, humans growing gardens for food and building roads for transportation).	**L4.1**-Organisms need food, water, and air; a way to dispose of waste; and an environment in which they can live.* **L4.2**-Organisms have basic needs. Animals require air, water, and a source of energy and building material for growth and repair. Plants also require light. **L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations. **L4.7**-Different kinds of organisms have characteristics that enable them to survive in different environments. Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing. **E4.11**-Humans depend on their natural and constructed environment. Humans change environments in ways that can either be beneficial or detrimental for themselves and other organisms.
K.5	Construct a model of a natural habitat (e.g., terrarium, ant farm, diorama) conducive to meeting the needs of plants and animals native to Alabama.	**L4.1**-Organisms need food, water, and air; a way to dispose of waste; and an environment in which they can live.* **L4.2**-Organisms have basic needs. Animals require air, water, and a source of energy and building material for growth and repair. Plants also require light. **L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations.

K.6	Identify and plan possible solutions (e.g., reducing, reusing, recycling) to lessen the human impact on the local environment.*	**E4.10**-The supply of many Earth resources such as fuels, metals, fresh water, and farmland is limited. Humans have devised methods for extending the use of Earth resources through recycling, reuse, and renewal. **E4.11**-Humans depend on their natural and constructed environment. Humans change environments in ways that can either be beneficial or detrimental for themselves and other organisms.
K.7	Observe and describe the effects of sunlight on Earth's surface (e.g., heat from the sun causing evaporation of water or increased temperature of soil, rocks, sand, and water).	**E4.7**-The Sun warms the land, air, and water and helps plants grow. **E4.8**-Weather changes from day to day and during the seasons. **E4.9**-Scientists use tools for observing, recording, and predicting weather changes from day to day and during the seasons.
K.8	Design and construct a device (e.g., hat, canopy, umbrella, tent) to reduce te effects of sunlight.*	**E4.7**-The Sun warms the land, air, and water and helps plants grow.
K.9	Observe, record, and share findings of local weather patterns over a period of time (e.g., increase in daily temperature from morning to afternoon, typical rain and storm patterns from season to season).	**E4.8**-Weather changes from day to day and during the seasons. **E4.9**-Scientists use tools for observing, recording, and predicting weather changes from day to day and during the seasons.
K.10	Ask questions to obtain information about the purpose of weather forecasts in planning for, preparing for, and responding to severe weather.*	**E4.8**-Weather changes from day to day and during the seasons. **E4.9**-Scientists use tools for observing, recording, and predicting weather changes from day to day and during the seasons.

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Grade 1 Alabama Course of Study Standard**	**Grade 4 NAEP Content Statements**
1.1	Conduct experiments to provide evidence that vibrations of matter can create sound (e.g., striking a tuning fork, plucking a guitar string) and sound can make matter vibrate (e.g., holding a piece of paper near a sound system speaker, touching your throat while speaking).	**P4.10**-Vibrating objects produce sound. The pitch of sound can be varied by changing the rate of vibration.
1.2	Construct explanations from observations that objects can be seen only when light is available to illuminate them (e.g., moon being illuminated by the sun, colors and patterns in the kaleidoscope being illuminated when held toward a light).	
1.3	Investigate materials to determine which types allow light to pass through (e.g., transparent materials such as clear plastic wrap), allow only partial light to pass through (e.g., translucent materials such as wax paper), block light (e.g., opaque materials such as construction paper), or reflect light (e. g., shiny materials such as aluminum foil).	**P4.2**-Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity. **P4.9**-Light travels in straight lines. When light strikes substances and objects through which it cannot pass, shadows result. When light travels obliquely from one substance to another (air and water), it changes direction.
1.4	Design and construct a device that uses light or sound to send a communication signal over a distance (e.g., using a flashlight and a piece of cardboard to simulate a signal lamp for sending a coded message to a classmate, using a paper cup and string to simulate a telephone for talking to a classmate).*	**P4.2**-Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity. **P4.9**-Light travels in straight lines. When light strikes substances and objects through which it cannot pass, shadows result. When light travels obliquely from one substance to another (air and water), it changes direction. **P4.10**-Vibrating objects produce sound. The pitch of sound can be varied by changing the rate of vibration.
1.5	Design a solution to a human problem by using materials to imitate how plants and/or animals use their external parts to help them survive, grow, and meet their needs (e.g., outerwear imitating animal furs for insulation, gear mimicking tree bark or shells for protection).*	**L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations. **L4.7**-Different kinds of organisms have characteristics that enable them to survive in different environments. Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

1.6	Obtain information to provide evidence that parents and their offspring engage in patterns of behavior that help the offspring survive (e.g., crying of offspring indicating need for feeding, quacking or barking by parents indicating protection of young).	**L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **L4.7**-Different kinds of organisms have characteristics that enable them to survive in different environments. Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.
1.7	Make observations to identify the similarities and differences of offspring to their parents and to other members of the same species (e.g., flowers from the same kind of plant being the same shape, but differing in size; dog being same breed as parent, but differing in fur color or pattern).	**L4.6**-Plants and animals closely resemble their parents.
1.8	Observe, describe, and predict patterns of the sun, moon, and stars as they appear in the sky (e.g., sun and moon appearing to rise in one part of the sky, move across the sky, and set; stars other than our sun being visible at night, but not during the day).	**E4.1**-Objects in the sky have patterns of movement. The Sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The Moon appears to move across the sky on a daily basis much like the Sun. **E4.2**-The observable shape of the Moon changes from day to day in a cycle that lasts about a month.
1.9	Observe seasonal patterns of sunrise and sunset to describe the relationship between the number of hours of daylight and the time of year (e.g., more hours of daylight during summer as compared to winter).	**E4.1**-Objects in the sky have patterns of movement. The Sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The Moon appears to move across the sky on a daily basis much like the Sun. **E4.2**-The observable shape of the Moon changes from day to day in a cycle that lasts about a month. **E4.8**-Weather changes from day to day and during the seasons. **E4.9**-Scientists use tools for observing, recording, and predicting weather changes from day to day and during the seasons.

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Grade K Alabama Course of Study Standard**	**Grade 4 NAEP Content Statements**
2.1	Conduct an investigation to describe and classify various substances according to physical properties (e.g., milk being a liquid, not clear in color, assuming shape of its container, mixing with water; mineral oil being a liquid, clear in color, taking shape of its container, floating in water; a brick being a solid, not clear in color, rough in texture, not taking the shape of its container, sinking in water)	**P4.1**-Objects and substances have properties. Weight (mass) and volume are properties that can be measured using appropriate tools.* **P4.3**-Matter exists in several different states; the most common states are solid, liquid, and gas. Each state of matter has unique properties. For instance, gases are easily compressed while solids and liquids are not. The shape of a solid is independent of its container; liquids and gases take the shape of their containers. **E4.6**-Some Earth materials have properties either in their present form or after design and modification that make them useful in solving human problems and enhancing the quality of life, as in the case of materials used for building or fuels used for heating and transportation.
2.2	Collect and evaluate data to determine appropriate uses of materials based on their properties (e.g., strength, flexibility, hardness, texture, absorbency). *	**P4.1**-Objects and substances have properties. Weight (mass) and volume are properties that can be measured using appropriate tools.* **E4.6**-Some Earth materials have properties either in their present form or after design and modification that make them useful in solving human problems and enhancing the quality of life, as in the case of materials used for building or fuels used for heating and transportation.
2.3	Demonstrate and explain how structures made from small pieces (e.g., linking cubes, blocks, building bricks, creative construction toys) can be disassembled and then rearranged to make new and different structures.	**P4.4**-Some objects are composed of a single substance; others are composed of more than one substance. **E4.6**-Some Earth materials have properties either in their present form or after design and modification that make them useful in solving human problems and enhancing the quality of life, as in the case of materials used for building or fuels used for heating and transportation.
2.4	Provide evidence that some changes in matter caused by heating or cooling can be reversed (e.g., heating or freezing of water) and some changes are irreversible (e.g., baking a cake, boiling an egg).	**P4.6**-One way to change matter from one state to another and back again is by heating and cooling.

2.5	Plan and carry out an investigation, using one variable at a time (e.g., water, light, soil, air), to determine the growth needs of plants.	**L4.1**-Organisms need food, water, and air; a way to dispose of waste; and an environment in which they can live.* **L4.2**-Organisms have basic needs. Animals require air, water, and a source of energy and building material for growth and repair. Plants also require light. **L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **E4.5**-Natural materials have different properties that sustain plant and animal life. **E4.7**-The Sun warms the land, air, and water and helps plants grow.
2.6	Design and construct models to simulate how animals disperse seeds or pollinate plants (e.g., animals brushing ur against seed pods and seeds falling off in other areas, birds and bees extracting nectar from flowers and transferring pollen from one plant to another).*	**L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **L4.7**-Different kinds of organisms have characteristics that enable them to survive in different environments. Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

2.7	Obtain information from literature and other media to illustrate that there are many different kinds of living things and that they exist in different places on land and in water (e.g., woodland, tundra, desert, rainforest, ocean, river).	**L4.1**-Organisms need food, water, and air; a way to dispose of waste; and an environment in which they can live.* **L4.2**-Organisms have basic needs. Animals require air, water, and a source of energy and building material for growth and repair. Plants also require light. **L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms. **L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations. **L4.7**-Different kinds of organisms have characteristics that enable them to survive in different environments. Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.
2.8	Make observations from media to obtain information about Earth's events that happen over a short period of time (e.g., tornados, volcanic explosions, earthquakes) or over a time period longer than one can observe (e.g., erosion of rocks, melting of glaciers).	**E4.3**-The surface of Earth changes. Some changes are due to slow processes such as erosion and weathering, and some changes are due to rapid processes such as landslides, volcanic eruptions, and earthquakes.
2.9	Create models to identify physical features of Earth (e.g., mountains, valleys, plains, deserts, lakes, rivers, oceans).	**E4.3**-The surface of Earth changes. Some changes are due to slow processes such as erosion and weathering, and some changes are due to rapid processes such as landslides, volcanic eruptions, and earthquakes.
2.10	Collect and evaluate data to identify water found on Earth and determine whether it is a solid or a liquid (e.g., glaciers as solid forms of water; oceans, lakes, rivers, streams as liquid forms of water).	**E4.4-**Earth materials that occur in nature include rocks, minerals, soils, water, and the gases of the atmosphere.
2.11	Examine and test solutions that address changes caused by Earth's events (e.g., dams for minimizing flooding, plants for controlling erosion).*	**E4.3**-The surface of Earth changes. Some changes are due to slow processes such as erosion and weathering, and some changes are due to rapid processes such as landslides, volcanic eruptions, and earthquakes.

2015 Alabama Course of Study: Science and NAEP Standards Correlation			
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.			
COS#	**Grade 3 Alabama Course of Study Standard**	**Grade 4 NAEP Content Statements**	**Grade 8 NAEP Content Statements**
3.1	Plan and carry out an experiment to determine the effects of balanced and unbalanced forces on the motion of an object using one variable at a time, including number, size, direction, speed, position, friction, or air resistance (e.g., balanced forces pushing from both sides on an object, such as a box, producing no motion; unbalanced force on one side of an object, such as a ball, producing motion), and communicate these findings graphically.	**P4.13**-An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far. **P4.14**-The motion of objects can be changed by pushing or pulling. The size of the change is related to the size of the force (push or pull) and the weight (mass) of the object on which the force is exerted. When an object does not move in response to a push or a pull, it is because another push or pull (friction) is being applied by the environment.	**P8.14**-An object's motion can be described by its speed and the direction in which it is moving. An object's position can be measured and graphed as a function of time. An object's speed can be measured and graphed as a function of time. **P8.16**-Forces have magnitude and direction. Forces can be added. The net force on an object is the sum of all the forces acting on the object. A nonzero net force on an object changes the object's motion; that is, the object's speed and/or direction of motion changes. A net force of zero on an object does not change the object's motion; that is, the object remains at rest or continues to move at a constant speed in a straight line.
3.2	Investigate, measure, and communicate in a graphical format how an observed pattern of motion (e.g., a child swinging in a swing, a ball rolling back and forth in a bowl, two children teetering on a see-saw, a model vehicle rolling down a ramp of varying heights, a pendulum swinging) can be used to predict the future motion of an object.	**P4.13**-An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far. **P4.14**-The motion of objects can be changed by pushing or pulling. The size of the change is related to the size of the force (push or pull) and the weight (mass) of the object on which the force is exerted. When an object does not move in response to a push or a pull, it is because another push or pull (friction) is being applied by the environment.	

3.3	Explore objects that can be manipulated in order to determine cause-and-effect relationships (e.g., distance between objects affecting strength of a force, orientation of magnets affecting direction of a magnetic force) of electric interactions between two objects not in contact with one another (e.g., force on hair from an electrically charged balloon, electrical forces between a charged rod and pieces of paper) or magnetic interactions between two objects not in contact with one another (e.g., force between two permanent magnets or between an electromagnet and steel paperclips, force exerted by one magnet versus the force exerted by two magnets).	**P4.5**-Magnets can repel or attract other magnets. They can also attract certain nonmagnetic objects at a distance.	**P8.15**-Some forces between objects act when the objects are in direct contact or when they are not touching. Magnetic, electrical, and gravitational forces can act at a distance.
3.4	Apply scientific ideas about magnets to solve a problem through an engineering design project (e. g., constructing a latch to keep a door shut, creating a device to keep two moving objects from touching each other such as a maglev system).*	**P4.5**-Magnets can repel or attract other magnets. They can also attract certain nonmagnetic objects at a distance.	**P8.15**-Some forces between objects act when the objects are in direct contact or when they are not touching. Magnetic, electrical, and gravitational forces can act at a distance.
3.5	Obtain and combine information to describe that organisms are classified as living things, rather than nonliving things, based on their ability to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.	**L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations. **L4.5**-Plants and animals have life cycles. Both plants and animals begin life and develop into adults, reproduce, and eventually die. The details of this life cycle are different for different organisms.	**L8.7**-The number of organisms and populations an ecosystem can support depends on the biotic resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. **L8.9**-Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.
3.6	Create representations to explain the unique and diverse life cycles of organisms other than humans (e.g., flowering plants, frogs, butterflies), including commonalities such as birth, growth, reproduction, and death.	**L4.5**-Plants and animals have life cycles. Both plants and animals begin life and develop into adults, reproduce, and eventually die. The details of this life cycle are different for different organisms.	**L8.9**-Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexuall
3.7	Examine data to provide evidence that plants and animals, excluding humans, have traits inherited from parents and that variations of these traits exist in groups of similar organisms (e.g., flower colors in pea plants, fur color and pattern in animal offspring).	**L4.6**-Plants and animals closely resemble their parents.	**L8.10**-The characteristics of organisms are influenced by heredity and environment. For some characteristics, inheritance is more important; for other characteristics, interactions with the environment are more important.

3.8	Engage in argument from evidence to justify that traits can be influenced by the environment (e.g., stunted growth in normally tall plants due to insufficient water, change in an arctic fox's fur color due to light and/or temperature, stunted growth of a normally large animal due to malnourishment).	**L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations.	**L8.10**-The characteristics of organisms are influenced by heredity and environment. For some characteristics, inheritance is more important; for other characteristics, interactions with the environment are more important.
3.9	Analyze and interpret data from fossils (e.g., type, size, distribution) to provide evidence of organisms and the environments in which they lived long ago (e.g., marine fossils on dry land, tropical plant fossils in arctic areas, fossils of extinct organisms in any environment).		**L8.11**-Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of a species is common; most of the species that have lived on the Earth no longer exist. **E8.3**-Fossils provide important evidence of how life and environmental conditions have changed in a given location. **E8.4**-Earth processes seen today, such as erosion and mountain building, make it possible to measure geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations.
3.10	Investigate how variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing (e.g., plants having larger thorns being less likely to be eaten by predators, animals having better camouflage coloration being more likely to survive and bear offspring).	**L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations. **L4.7**-Different kinds of organisms have characteristics that enable them to survive in different environments. Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.	**L8.11**-Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of a species is common; most of the species that have lived on the Earth no longer exist.

3.11	Construct an argument from evidence to explain the likelihood of an organism's ability to survive when compared to the resources in a certain habitat (e.g., freshwater organisms survive well, less well, or not at all in saltwater; desert organisms survive well, less well, or not at all in woodlands). ~Construct explanations that forming groups helps some organisms survive. ~Create models that illustrate how organisms and their habitats make up a system in which the parts depend on each other. ~Categorize resources in various habitats as basic materials (e.g., sunlight, air, freshwater, soil), produced materials (e.g., food, fuel, shelter), or as nonmaterial (e.g., safety, instinct, nature-learned behaviors).	**L4.1**-Organisms need food, water, and air; a way to dispose of waste; and an environment in which they can live.* **L4.2**-Organisms have basic needs. Animals require air, water, and a source of energy and building material for growth and repair. Plants also require light. **L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms.	**L8.7**-The number of organisms and populations an ecosystem can support depends on the biotic resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. **L8.8**-All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organisms or other organisms, whereas others are beneficial.
3.12	Evaluate engineered solutions to a problem created by environmental changes and any resulting impacts on the types and density of plant and animal populations living in the environment (e.g., replanting of sea oats in coastal areas due to destruction by hurricanes, creating property development restrictions in vacation areas to reduce displacement and loss of native animal populations).*	**L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations. **E4.11**-Humans depend on their natural and constructed environment. Humans change environments in ways that can either be beneficial or detrimental for themselves and other organisms.	**L8.7**-The number of organisms and populations an ecosystem can support depends on the biotic resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. **L8.8**-All organisms cause changes in the environment where they live. Some of these changes are detrimental to the organisms or other organisms, whereas others are beneficial. **L8.11**-Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of a species is common; most of the species that have lived on the Earth no longer exist.

3.13	Display data graphically and in tables to describe typical weather conditions expected during a particular season (e.g., average temperature, precipitation, wind direction).	**E4.8**-Weather changes from day to day and during the seasons. **E4.9**-Scientists use tools for observing, recording, and predicting weather changes from day to day and during the seasons.	**E8.13**-Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate because water in the oceans holds a large amount of heat. **E8.14**-Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. Water evaporates from Earth's surface, rises and cools as it moves to higher elevations, condenses as clouds, falls as rain or snow, and collects in lakes, oceans, soil, and underground.
3.14	Collect information from a variety of sources to describe climates in different regions of the world.		**E8.13**-Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate because water in the oceans holds a large amount of heat.
3.15	Evaluate a design solution (e.g., flood barriers, wind resistant roofs, lightning rods) that reduces the impact of a weather-related hazard.*	**E4.11**-Humans depend on their natural and constructed environment. Humans change environments in ways that can either be beneficial or detrimental for themselves and other organisms.	**E8.15**-Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed Earth's land, oceans, and atmosphere. Studies of plant and animal populations have shown that such activities can reduce the number and variety of wild plants and animals and sometimes result in the extinction of species.

2015 Alabama Course of Study: Science and NAEP Standards Correlation			
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the *2015 Alabama Course of Study: Science.* Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.			
COS#	**Grade 4 Alabama Course of Study Standard**	**Grade 4 NAEP Content Statements**	**Grade 8 NAEP Content Statements**
4.1	Use evidence to explain the relationship of the speed of an object to the energy of that object.		**P8.8**-Objects and substances in motion have kinetic energy. For example, a moving baseball can break a window; water flowing down a stream moves pebbles and floating objects along with it.
4.2	Plan and carry out investigations that explain transference of energy from place to place by sound, light, heat, and electric currents. ~Provide evidence that heat can be produced in many ways (e.g., rubbing hands together, burning leaves) and can move from one object to another by conduction. ~Demonstrate that different objects can absorb, reflect, and/or conduct energy. ~Demonstrate that electric circuits require a complete loop through which an electric current can pass.	**P4.2**-Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity. **P4.7**-Heat (thermal energy), electricity, light, and sound are forms of energy. **P4.8**-Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows though wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy. **P4.11**-Electricity flowing through an electrical circuit produces magnetic effects in the wires. In an electrical circuit containing a battery, a bulb, and a bell, energy from the battery is transferred to the bulb and the bell, which in turn transfer the energy to their surroundings as light, sound, and heat (thermal energy).	**P8.10**-Energy is transferred from place to place. Light energy from the Sun travels through space to Earth (radiation). Thermal energy travels from a flame through the metal of a cooking pan to the water in the pan (conduction). Air warmed by a fireplace moves around a room (convection). Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter.
4.3	Investigate to determine changes in energy resulting from increases or decreases in speed that occur when objects collide.		**P8.10**-Energy is transferred from place to place. Light energy from the Sun travels through space to Earth (radiation). Thermal energy travels from a flame through the metal of a cooking pan to the water in the pan (conduction). Air warmed by a fireplace moves around a room (convection). Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter.

4.4	Design, construct, and test a device that changes energy from one form to another (e.g., electric circuits converting electrical energy into motion, light, or sound energy; a passive solar heater converting light energy into heat energy).*	**P4.7**-Heat (thermal energy), electricity, light, and sound are forms of energy. **P4.8**-Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows though wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy. **P4.11**-Electricity flowing through an electrical circuit produces magnetic effects in the wires. In an electrical circuit containing a battery, a bulb, and a bell, energy from the battery is transferred to the bulb and the bell, which in turn transfer the energy to their surroundings as light, sound, and heat (thermal energy).	**P8.10**-Energy is transferred from place to place. Light energy from the Sun travels through space to Earth (radiation). Thermal energy travels from a flame through the metal of a cooking pan to the water in the pan (conduction). Air warmed by a fireplace moves around a room (convection). Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter.
4.5	Compile information to describe how the use of energy derived from natural renewable and nonrenewable resources affects the environment (e.g., constructing dams to harness energy from water, a renewable resource, while causing a loss of animal habitats; burning of fossil fuels, a nonrenewable resource, while causing an increase in air pollution; installing solar panels to harness energy from the sun, a renewable resource, while requiring specialized materials that necessitate mining).	**E4.6**-Some Earth materials have properties either in their present form or after design and modification that make them useful in solving human problems and enhancing the quality of life, as in the case of materials used for building or fuels used for heating and transportation. **E4.7**-The Sun warms the land, air, and water and helps plants grow.	
4.6	Develop a model of waves to describe patterns in terms of amplitude and wavelength, and including that waves can cause objects to move.		**P8.10**-Energy is transferred from place to place. Light energy from the Sun travels through space to Earth (radiation). Thermal energy travels from a flame through the metal of a cooking pan to the water in the pan (conduction). Air warmed by a fireplace moves around a room (convection). Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter.

4.7	Develop and use models to show multiple solutions in which patterns are used to transfer information (e.g., using a grid of 1s and 0s representing black and white to send information about a picture, using drums to send coded information through sound waves, using Morse code to send a message).*		
4.8	Construct a model to explain that an object can be seen when light reflected from its surface enters the eyes.	**P4.2**-Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity. **P4.9**-Light travels in straight lines. When light strikes substances and objects through which it cannot pass, shadows result. When light travels obliquely from one substance to another (air and water), it changes direction.	

4.9	Examine evidence to support an argument that the internal and external structures of plants (e.g., thorns, leaves, stems, roots, colored petals, xylem, phloem) and animals (e.g., heart, stomach, lung, brain, skin) function to support survival, growth, behavior, and reproduction.	**L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations.	**L8.1**-All organisms are composed of cells, from one cell only to many cells. About two-thirds of the weight of cells is accounted for by water, which gives cells many of their properties. In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal. The way in which cells function is similar in all living organisms. **L8.11**-Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of a species is common; most of the species that have lived on the Earth no longer exist. **L8.12**-Similarities among organisms are found in anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance.
4.10	Obtain and communicate information explaining that humans have systems that interact with one another for digestion, respiration, circulation, excretion, movement, control, coordination, and protection from disease.		**L8.1**-All organisms are composed of cells, from one cell only to many cells. About two-thirds of the weight of cells is accounted for by water, which gives cells many of their properties. In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal. The way in which cells function is similar in all living organisms.

4.11	Investigate different ways animals receive information through the senses, process that information, and respond to it in different ways (e.g., skunks lifting tails and spraying an odor when threatened, dogs moving ears when reacting to sound, snakes coiling or striking when sensing vibrations).	**L4.4**-When the environment changes, some plants and animals survive and reproduce; others die or move to new locations.	**L8.11**-Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of a species is common; most of the species that have lived on the Earth no longer exist.
4.12	Construct explanations by citing evidence found in patterns of rock formations and fossils in rock layers that Earth changes over time through both slow and rapid processes (e.g., rock layers containing shell fossils appearing above rock layers containing plant fossils and no shells indicating a change from land to water over time, a canyon with different rock layers in the walls and a river in the bottom indicating that over time a river cut through the rock).	**E4.3**-The surface of Earth changes. Some changes are due to slow processes such as erosion and weathering, and some changes are due to rapid processes such as landslides, volcanic eruptions, and earthquakes. **E4.4**: Earth materials that occur in nature include rocks, minerals, soils, water, and the gases of the atmosphere.	**E8.4**-Earth processes seen today, such as erosion and mountain building, make it possible to measure geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations. **E8.5**-Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. Some formations show evidence that they were deposited by volcanic eruptions. Others are composed of sand and smaller particles that are buried and cemented by dissolved minerals to form solid rock again. Still others show evidence that they were once earlier rock types that were exposed to heat and pressure until they changed shape and, in some cases, melted and recrystallized. **E8.6**-Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers with each having a different chemical composition and texture.

4.13	Plan and carry out investigations to examine properties of soils and soil types (e.g., color, texture, capacity to retain water, ability to support growth of plants).	**E4.4**: Earth materials that occur in nature include rocks, minerals, soils, water, and the gases of the atmosphere.	**E8.5**-Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. Some formations show evidence that they were deposited by volcanic eruptions. Others are composed of sand and smaller particles that are buried and cemented by dissolved minerals to form solid rock again. Still others show evidence that they were once earlier rock types that were exposed to heat and pressure until they changed shape and, in some cases, melted and recrystallized. **E8.6**-Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers with each having a different chemical composition and texture.
4.14	Explore information to support the claim that landforms are the result of a combination of constructive forces, including crustal deformation, volcanic eruptions, and sediment deposition as well as a result of destructive forces, including erosion and weathering.	**E4.3**-The surface of Earth changes. Some changes are due to slow processes such as erosion and weathering, and some changes are due to rapid processes such as landslides, volcanic eruptions, and earthquakes.	**E8.5**-Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. Some formations show evidence that they were deposited by volcanic eruptions. Others are composed of sand and smaller particles that are buried and cemented by dissolved minerals to form solid rock again. Still others show evidence that they were once earlier rock types that were exposed to heat and pressure until they changed shape and, in some cases, melted and recrystallized.
4.15	Analyze and interpret data (e.g., angle of slope in downhill movement of water, volume of water flow, cycles of freezing and thawing of water, cycles of heating and cooling of water, speed of wind, relative rate of soil deposition, amount of vegetation) to determine effects of weathering and rate of erosion by water, ice, wind, and vegetation using one single form of weathering or erosion at a time.	**E4.3**-The surface of Earth changes. Some changes are due to slow processes such as erosion and weathering, and some changes are due to rapid processes such as landslides, volcanic eruptions, and earthquakes.	**E8.5**-Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. Some formations show evidence that they were deposited by volcanic eruptions. Others are composed of sand and smaller particles that are buried and cemented by dissolved minerals to form solid rock again. Still others show evidence that they were once earlier rock types that were exposed to heat and pressure until they changed shape and, in some cases, melted and recrystallized.

4.16	Describe patterns of Earth's features on land and in the ocean using data from maps (e.g., topographic maps of Earth's land and ocean floor; maps of locations of mountains, continental boundaries, volcanoes, and earthquakes).		
4.17	Formulate and evaluate solutions to limit the effects of natural Earth processes on humans (e.g., designing earthquake, tornado, or hurricane-resistant buildings; improving monitoring of volcanic activity).*	**E4.11**-Humans depend on their natural and constructed environment. Humans change environments in ways that can either be beneficial or detrimental for themselves and other organisms.	

2015 Alabama Course of Study: Science and NAEP Standards Correlation			
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the *2015 Alabama Course of Study: Science.* Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.			
COS#	**Grade 5 Alabama Course of Study Standard**	**Grade 4 NAEP Content Statements**	**Grade 8 NAEP Content Statements**
5.1	Plan and carry out investigations (e.g., adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, evaporating salt water) to provide evidence that matter is made of particles too small to be seen.	**P4.3**-Matter exists in several different states; the most common states are solid, liquid, and gas. Each state of matter has unique properties. For instance, gases are easily compressed while solids and liquids are not. The shape of a solid is independent of its container; liquids and gases take the shape of their containers. **P4.4**-Some objects are composed of a single substance; others are composed of more than one substance.	**P8.1**-Properties of solids, liquids, and gases are explained by a model of matter that is composed of tiny particles in motion.
5.2	Investigate matter to provide mathematical evidence, including graphs, to show that regardless of the type of reaction (e.g., new substance forming due to dissolving or mixing) or change (e.g., phase change) that occurs when heating, cooling, or mixing substances, the total weight of the matter is conserved.	**P4.1**-Objects and substances have properties. Weight (mass) and volume are properties that can be measured using appropriate tools.* **P4.3**-Matter exists in several different states; the most common states are solid, liquid, and gas. Each state of matter has unique properties. For instance, gases are easily compressed while solids and liquids are not. The shape of a solid is independent of its container; liquids and gases take the shape of their containers. **P4.6**-One way to change matter from one state to another and back again is by heating and cooling.	**P8.4**-Elements are a class of substances composed of a single kind of atom. Compounds are composed of two or more different elements. Each element and compound has physical and chemical properties, such as boiling point, density, color, and conductivity, which are independent of the amount of the sample.† **P8.6**-Changes of state are explained by a model of matter composed of tiny particles that are in motion. When substances undergo changes of state, neither atoms nor molecules themselves are changed in structure. Mass is conserved when substances undergo changes of state. **P8.7**-Chemical changes can occur when two substances, elements, or compounds react and produce one or more different substances whose physical and chemical properties are different from the reacting substances. When substances undergo chemical change, the number and kinds of atoms in the reactants are the same as the number and kinds of atoms in the products. Mass is conserved when substances undergo chemical change. The mass of the reactants is the same as the mass of the products.

5.3	Examine matter through observations and measurements to identify materials (e.g., powders, metals, minerals, liquids) based on their properties (e.g., color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, solubility, density).	**P4.1**-Objects and substances have properties. Weight (mass) and volume are properties that can be measured using appropriate tools.* **P4.3**-Matter exists in several different states; the most common states are solid, liquid, and gas. Each state of matter has unique properties. For instance, gases are easily compressed while solids and liquids are not. The shape of a solid is independent of its container; liquids and gases take the shape of their containers.	**P8.4**-Elements are a class of substances composed of a single kind of atom. Compounds are composed of two or more different elements. Each element and compound has physical and chemical properties, such as boiling point, density, color, and conductivity, which are independent of the amount of the sample.† **P8.6**-Changes of state are explained by a model of matter composed of tiny particles that are in motion. When substances undergo changes of state, neither atoms nor molecules themselves are changed in structure. Mass is conserved when substances undergo changes of state. **P8.7**-Chemical changes can occur when two substances, elements, or compounds react and produce one or more different substances whose physical and chemical properties are different from the reacting substances. When substances undergo chemical change, the number and kinds of atoms in the reactants are the same as the number and kinds of atoms in the products. Mass is conserved when substances undergo chemical change. The mass of the reactants is the same as the mass of the products.
5.4	Investigate whether the mixing of two or more substances results in new substances (e.g., mixing of baking soda and vinegar resulting in the formation of a new substance, gas; mixing of sand and water resulting in no new substance being formed).	**P4.3**-Matter exists in several different states; the most common states are solid, liquid, and gas. Each state of matter has unique properties. For instance, gases are easily compressed while solids and liquids are not. The shape of a solid is independent of its container; liquids and gases take the shape of their containers. **P4.4**-Some objects are composed of a single substance; others are composed of more than one substance.	**P8.4**-Elements are a class of substances composed of a single kind of atom. Compounds are composed of two or more different elements. Each element and compound has physical and chemical properties, such as boiling point, density, color, and conductivity, which are independent of the amount of the sample.†

5.5	Construct explanations from observations to determine how the density of an object affects whether the object sinks or floats when placed in a liquid.	**P4.3**-Matter exists in several different states; the most common states are solid, liquid, and gas. Each state of matter has unique properties. For instance, gases are easily compressed while solids and liquids are not. The shape of a solid is independent of its container; liquids and gases take the shape of their containers.	
5.6	Construct an explanation from evidence to illustrate that the gravitational force exerted by Earth on objects is directed downward towards the center of Earth.		
5.7	Design and conduct a test to modify the speed of a falling object due to gravity (e.g., constructing a parachute to keep an attached object from breaking).*		
5.8	Defend the position that plants obtain materials needed for growth primarily from air and water.		**P8.4**-Plants are producers; that is, they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water.‡ Plants use these sugars along with minerals from the soil to form fats, proteins, and carbohydrates. These products can be used immediately, incorporated into the plant's cells as the plant grows, or stored for later use.
5.9	Construct an illustration to explain how plants use light energy to convert carbon dioxide and water into a storable fuel, carbohydrates, and a waste product, oxygen, during the process of photosynthesis.		**P8.13**-Nuclear reactions take place in the Sun. In plants, light from the Sun is transferred to oxygen and carbon compounds, which, in combination, have chemical potential energy (photosynthesis). **P8.4**-Plants are producers; that is, they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water.‡ Plants use these sugars along with minerals from the soil to form fats, proteins, and carbohydrates. These products can be used immediately, incorporated into the plant's cells as the plant grows, or stored for later use. **E8.11**-The Sun is the major source of energy for phenomena on Earth's surface. It provides energy for plants to grow and drives convection within the atmosphere and oceans, producing winds, ocean currents, and the water cycle.

5.10	Construct and interpret models (e.g., diagrams, flow charts) to explain that energy in animals' food is used for body repair, growth, motion, and maintenance of body warmth and was once energy from the sun.		**P8.5**-All animals, including humans, are consumers that meet their energy needs by eating other organisms or their products. Consumers break down the structures of the organisms they eat to make the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products to meet their energy needs. **P8.6**-Two types of organisms may interact with one another in several ways: They may be in a producer/ consumer, predator/prey, or parasite/ host relationship. Or, one organism may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.
5.11	Create a model to illustrate the transfer of matter among producers; consumers, including scavengers and decomposers; and the environment.	**L4.3**-Organisms interact and are interdependent in various ways, including providing food and shelter to one another. Organisms can survive only in environments in which their needs are met. Some interactions are beneficial; others are detrimental to the organism and other organisms.	**P8.5**-All animals, including humans, are consumers that meet their energy needs by eating other organisms or their products. Consumers break down the structures of the organisms they eat to make the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products to meet their energy needs. **P8.6**-Two types of organisms may interact with one another in several ways: They may be in a producer/ consumer, predator/prey, or parasite/ host relationship. Or, one organism may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.
5.12	Defend the claim that one factor determining the apparent brightness of the sun compared to other stars is the relative distance from Earth.		

5.13	Analyze data and represent with graphs to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky (e.g., shadows and the position and motion of Earth with respect to the sun, visibility of select stars only in particular months).	**E4.1**-Objects in the sky have patterns of movement. The Sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons. The Moon appears to move across the sky on a daily basis much like the Sun.	**E8.1**-In contrast to an earlier theory that Earth is the center of the universe, it is now known that the Sun, an average star, is the central and largest body in the solar system. Earth is the third planet from the Sun in a system that includes seven other planets and their moons, as well as smaller objects such as asteroids and comets. **E8.2**-Gravity is the force that keeps most objects in the solar system in regular and predictable motion. These motions explain such phenomena as the day, the year, phases of the Moon, and eclipses. **E8.12**-Seasons result from annual variations in the intensity of sunlight and length of day, due to the tilt of Earth's rotation axis relative to the plane of its yearly orbit around the Sun.
5.14	Use a model to represent how any two systems, specifically the atmosphere, biosphere, geosphere, and/or hydrosphere, interact and support life (e.g., influence of the ocean on ecosystems, landform shape, and climate; influence of the atmosphere on landforms and ecosystems through weather and climate; influence of mountain ranges on winds and clouds in the atmosphere).		
5.15	Identify the distribution of freshwater and salt water on Earth (e.g., oceans, lakes, rivers, glaciers, ground water, polar ice caps) and construct a graphical representation depicting the amounts and percentages found in different reservoirs.	**E4.10**-The supply of many Earth resources such as fuels, metals, fresh water, and farmland is limited. Humans have devised methods for extending the use of Earth resources through recycling, reuse, and renewal.	
5.16	Collect and organize scientific ideas that individuals and communities can use to protect Earth's natural resources and its environment (e. g., terracing land to prevent soil erosion, utilizing no-till farming to improve soil fertility, regulating emissions from factories and automobiles to reduce air pollution, recycling to reduce overuse of landfill areas).	**E4.10**-The supply of many Earth resources such as fuels, metals, fresh water, and farmland is limited. Humans have devised methods for extending the use of Earth resources through recycling, reuse, and renewal.	**E8.15**-Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed Earth's land, oceans, and atmosphere. Studies of plant and animal populations have shown that such activities can reduce the number and variety of wild plants and animals and sometimes result in the extinction of species.

5.17	Design solutions, test, and revise a process for cleaning a polluted environment (e.g., simulating an oil spill in the ocean or a flood in a city and creating a solution for containment and/or cleanup).*	**E4.10**-The supply of many Earth resources such as fuels, metals, fresh water, and farmland is limited. Humans have devised methods for extending the use of Earth resources through recycling, reuse, and renewal. **E4.11**-Humans depend on their natural and constructed environment. Humans change environments in ways that can either be beneficial or detrimental for themselves and other organisms.	**E8.15**-Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed Earth's land, oceans, and atmosphere. Studies of plant and animal populations have shown that such activities can reduce the number and variety of wild plants and animals and sometimes result in the extinction of species.

2015 Alabama Course of Study: Science and NAEP Standards Correlation			
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the *2015 Alabama Course of Study: Science.* Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.			
COS#	**Grade 6 Alabama Course of Study Standard**	**Grade 8 NAEP Content Statements**	**Grade 12 NAEP Content Statements**
6.1	Create and manipulate models (e.g., physical, graphical, conceptual) to explain the occurrences of day/night cycles, length of year, seasons, tides, eclipses, and lunar phases based on patterns of the observed motions of celestial bodies.	**E8.2**-Gravity is the force that keeps most objects in the solar system in regular and predictable motion. These motions explain such phenomena as the day, the year, phases of the moon, and eclipses. **E8.12**-Seasons result from annual variations in the intensity of sunlight and length of day, due to the tilt of Earth's rotation axis relative to the plane of its yearly orbit around the sun.	
6.2	Construct models and use simulations (e.g., diagrams of the relationship between Earth and man-made satellites, rocket launch, International Space Station, elliptical orbits, black holes, life cycles of stars, orbital periods of objects within the solar system, astronomical units and light years) to explain the role of gravity in affecting the motions of celestial bodies (e.g., planets, moons, comets, asteroids, meteors) within galaxies and the solar system.	**E8.1a**-In contrast to an earlier theory that Earth is the center of the universe, it is now known that the Sun, an average star, is the central and largest body in the solar system. **E8.1b**-Earth is the third planet from the Sun in a system that includes seven other planets and their moons, as well as smaller objects such as asteroids and comets. **E8.2**-Gravity is the force that keeps most objects in the solar system in regular and predictable motion. These motions explain such phenomena as the day, the year, phases of the moon, and eclipses.	**E12.2**-Early in the history of the universe, matter (primarily the light atoms hydrogen and helium) clumped together by gravitational attraction to form countless trillions of stars and billions of galaxies.
6.3	Develop and use models to determine scale properties of objects in the solar system (e.g., scale model representing sizes and distances of the sun, Earth, moon system based on a one-meter diameter sun).		

6.4	Construct explanations from geologic evidence (e. g., change or extinction of particular living organisms; field evidence or representations, including models of geologic cross-sections; sedimentary layering) to identify patterns of Earth's major historical events (e.g., formation of mountain chains and ocean basins, significant volcanic eruptions, fossilization, folding, faulting, igneous intrusion, erosion).	**E8.3**-Fossils provide important evidence of how life and environmental conditions have changed in a given location. **E8.4**-Earth process seen today, such as erosion and mountain building, make it possible to measure geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations. **E8.9b**-Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.	
6.5	Use evidence to explain how different geologic processes shape Earth's history over widely varying scales of space and time (e.g., chemical and physical erosion; tectonic plate processes; volcanic eruptions; meteor impacts; regional geographical features, including Alabama fault lines, Rickwood Caverns, and Wetumpka Impact Crater).	**P8.10e**-Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter. **E8.4**-Earth process seen today, such as erosion and mountain building, make it possible to measure geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations. **E8.9a**-Lithospheric plates on the scale of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. **E8.9b**-Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.	
6.6	Provide evidence from data of the distribution of fossils and rocks, continental shapes, and seafloor structures to explain past plate motions.	**E8.3**-Fossils provide important evidence of how life and environmental conditions have changed in a given location. **E8.4**-Earth process seen today, such as erosion and mountain building, make it possible to measure geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations.	

6.7	Use models to construct explanations of the various biogeochemical cycles of Earth (e.g., water, carbon, nitrogen) and the flow of energy that drives these processes.	**E8.14a**-Water, which covers the majority of Earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the water cycle. **E8.14b**-Water evaporates from Earth's surface, rises and cools as it moves to higher elevations, condenses as clouds, falls as rain or snow, and collects in lakes, oceans, soil, and underground.	**E12.11**-Earth is a system contining essentially a fixed amount of each stable chemical atom or element. Most elements can exist in several different chemical forms. Earth elements move within and between the lithosphere, atmosphere, hydroshere, and biosphere as part of biogeochemical cycles.
6.8	Plan and carry out investigations that demonstrate the chemical and physical processes that form rocks and cycle Earth materials (e.g., processes of crystallization, heating and cooling, weathering, deformation, and sedimentation).	**E8.5a**-Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them. **E8.5b**-Some formations show evidence that they were deposited by volcanic eruptions. **E8.5c**-Others are composed of sand and smaller particles that are buried and cemented by dissolved minerals to form solid rock again. **E8.5d**-Still others show evidence that they were once earlier rock types that were exposed to heat and pressure until they changed shape and, in some cases, melted and recrystallized.	
6.9	Use models to explain how the flow of Earth's internal energy drives a cycling of matter between Earth's surface and deep interior causing plate movements (e.g., mid-ocean ridges, ocean trenches, volcanoes, earthquakes, mountains, rift valleys, volcanic islands).	**E8.8**-Earth is layered with a lithosphere; a hot convecting mantle; and a dense, metallic core. **E8.9a**-Lithospheric plates on the scale of continents and oceans constantly move at rates of centimeters per year in response to movements in the mantle. **E8.9b**-Major geological events, such as earthquakes, volcanic eruptions, and mountain building, result from these plate motions.	**E12.12a**-Movement of matter through Earth's systems is driven by Earth's internal and external sources of energy.
6.10	Use research-based evidence to propose a scientific explanation regarding how the distribution of Earth's resources such as minerals, fossil fuels, and groundwater are the result of ongoing geoscience processes (e.g., past volcanic and hydrothermal activity, burial of organic sediments, active weathering of rock).		

6.11	Develop and use models of Earth's interior composition to illustrate the resulting magnetic field (e.g., magnetic poles) and to explain its measureable effects (e.g., protection from cosmic radiation).	**E8.8**-Earth is layered with a lithosphere; a hot convecting mantle; and a dense, metallic core. **E8.10a**-Earth as a whole has a magnetic field that is detectable at the surface with a compass. **E8.10b**-Earth's magnetic field is similar to the field of a natural or manmade magnet with north and south poles and lines of force. **E8.10c**-For thousands of years, people have used compasses to aid in navigation on land and sea.	
6.12	Integrate qualitative scientific and technical information (e.g., weather maps; diagrams; other visualizations, including radar and computer simulations) to support the claim that motions and complex interactions of air masses result in changes in weather conditions.		
6.12a	Use various instruments (e.g., thermometers, barometers, anemometers, wet bulbs) to monitor local weather and examine weather patterns to predict various weather events, especially the impact of severe weather (e.g., fronts, hurricanes, tornados, blizzards, ice storms, droughts).		
6.13	Use models (e.g., diagrams, maps, globes, digital representations) to explain how the rotation of Earth and unequal heating of its surface create patterns of atmospheric and oceanic circulation that determine regional climates.	**E8.11a**-The Sun is the major source of energy for phenomena on Earth's surface. **E8.11b**-It provides energy for plants to grow and drives convection within the atmosphere and oceans, producing winds, ocean currents, and the water cycle. **E8.13a**-Global patterns of atmospheric movement influence local weather. **E8.13b**-Oceans have a major effect on climate because water in the oceans holds a large amount of heat.	

6.13a	Use experiments to investigate how energy from the sun is distributed between Earth's surface and its atmosphere by convection and radiation (e.g., warmer water in a pan rising as cooler water sinks, warming one's hands by a campfire).	**P8.10a**-Energy is transferred from place to place. **P8.10b**-Light energy from the sun travels through space to Earth (radiation). **P8.10c**-Thermal energy travels from a flame through the metal of a cooking pan (conduction). **P8.10d**-Air warmed by a fireplace moves around a room (convection). **P8.10e**-Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter. **P8.11a**-A tiny fraction of the light energy from the Sun reaches Earth. **P8.11b**-Light energy from the Sun is Earth's primary source of energy, heating Earth surfaces and providing the energy that results in wind, ocean currents, and storms. **E8.11a**-The Sun is the major source of energy for phenomena on Earth's surface. **E8.11b**-It provides energy for plants to grow and drives convection within the atmosphere and oceans, producing winds, ocean currents, and the water cycle.	
6.14	Analyze and interpret data (e.g., tables, graphs, maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; rates of human activities) to describe how various human activities (e.g., use of fossil fuels, creation of urban heat islands, agricultural practices) and natural processes (e.g., solar radiation, greenhouse effect, volcanic activity) may cause changes in local and global temperatures over time.	**E8.7a**-The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. **E8.7b**-The atmosphere has a different physical and chemical composition at different elevations.	

6.15	Analyze evidence (e.g., databases on human populations, rates of consumption of food and other natural resources) to explain how changes in human population, per capita consumption of natural resources, and other human activities (e.g., land use, resource development, water and air pollution, urbanization) affect Earth's systems.	**E8.15a**-Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed Earth's land, oceans, and atmosphere. **E8.15b**-Studies of plant and animal populations have shown that such activities can reduce the number and variety of wild plants and animals and sometimes result in extinct species.	
6.16	Implement scientific principles to design processes for monitoring and minimizing human impact on the environment (e.g., water usage, including withdrawal of water from streams and aquifers or construction of dams and levees; land usage, including urban development, agriculture, or removal of wetlands; pollution of air, water, and land).*	**E8.15a**-Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed Earth's land, oceans, and atmosphere. **E8.15b**-Studies of plant and animal populations have shown that such activities can reduce the number and variety of wild plants and animals and sometimes result in extinct species.	

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Grade 7 Alabama Course of Study Standard**	**Grade 8 NAEP Content Statements**
7.1	Engage in argument from evidence to support claims of the cell theory.	**L8.1a-**All organisms are composed of cells, from one cell only to many cells. **L8.3a-**Cells carry out the many functions needed to sustain life. **L8.3b-**They (cells) grow and divide, thereby producing more cells.
7.2	Gather and synthesize information to explain how prokaryotic and eukaryotic cells differ in structure and function, including the methods of asexual and sexual reproduction.	**L8.1e-**The way in which cells function is similar in all living organisms. **L8.2-**Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissues of an embryo. **L8.9a-**Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. **L8.9b-**Some organisms reproduce asexually. **L8.9c-**Other organisms reproduce sexually.
7.3	Construct an explanation of the function (e.g., mitochondria releasing energy during cellular respiration) of specific cell structures (i.e., nucleus, cell membrane, cell wall, ribosomes, mitochondria, chloroplasts, and vacuoles) for maintaining a stable environment.	**L8.1b-**About two thirds of the weight of cells is accounted for by water, which gives cells many of their properties.
7.4	Construct models and representations of organ systems (e.g., circulatory, digestive, respiratory, muscular, skeletal, nervous) to demonstrate how multiple interacting organs and systems work together to accomplish specific functions.	**L8.1c-**In multicellular organisms, specialized cells perform specialized functions. **L8.1d-**Organs and organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal.

7.5	Examine the cycling of matter between abiotic and biotic parts of ecosystems to explain the flow of energy and the conservation of matter.	**P8.13a-**Nuclear reactions take place in the Sun. **L8.4a-**Plants are producers; that is, they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water. **L8.5a-**All animals, including humans, are consumers that meet their energy needs by eating other organisms or their products. **L8.5b-**Consumers break down the structures of the organisms they eat to make the materials they need to grow and function. **L8.5c-**Decomposers, including bacteria and fungi, use dead organisms or their products to meet their energy needs.
7.5a	Obtain, evaluate, and communicate information about how food is broken down through chemical reactions to create new molecules that support growth and/or release energy as it moves through an organism.	**P8.13b-**In plants, light from the Sun is transferred to oxygen and carbon compounds, which, in combination, have chemical potential energy (photosynthesis). **L8.3c-**Food is used to provide energy for the work that cells do and is a source of the molecular building blocks from which needed materials are assembled.
7.5b	Generate a scientific explanation based on evidence for the role of photosynthesis and cellular respiration in the cycling of matter and flow of energy into and out of organisms.	**L8.4b-**Plants use these sugars along with minerals from the soil to form fats, proteins, and carbohydrates. **L8.4c-**These products can be used immediately, incorporated into the plant' s cells as the plant grows, or stored for later use.
7.6	Analyze and interpret data to provide evidence regarding how resource availability impacts individual organisms as well as populations of organisms within an ecosystem.	**L8.7-**The number of organisms and populations an ecosystem can support depends on the biotic resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition.
7.7	Use empirical evidence from patterns and data to demonstrate how changes to physical or biological components of an ecosystem (e.g., deforestation, succession, drought, fire, disease, human activities, invasive species) can lead to shifts in populations.	**L8.8a-**All organisms cause changes in the environment where they live. **L8.8b-**Some of these changes are detrimental to the organisms or other organisms, whereas others are beneficial.

7.8	Construct an explanation to predict patterns of interactions in different ecosystems in terms of the relationships between and among organisms (e. g., competition, predation, mutualism, commensalism, parasitism).	**L8.6a-**Two types of organisms may interact with one another in several ways: They may be in a producer/consumer, predator/prey, or parasite/host relationship. **L8.6b-**Or, one organism may scavenge or decompose another. **L8.6c-**Relationships may be competitive or mutually beneficial. **L8.6d-**Some species have become so adapted to each other that neither could survive with the other.
7.9	Engage in argument to defend the effectiveness of a design solution that maintains biodiversity and ecosystem services (e.g., using scientific, economic, and social considerations regarding purifying water, recycling nutrients, preventing soil erosion).	
7.10	Use evidence and scientific reasoning to explain how characteristic animal behaviors (e.g., building nests to protect young from cold, herding to protect young from predators, attracting mates for breeding by producing special sounds and displaying colorful plumage, transferring pollen or seeds, creating conditions for seed germination and growth) and specialized plant structures (e.g., flower brightness, nectar, and odor attracting birds that transfer pollen; hard outer shells on seeds providing protection prior to germination) affect the probability of successful reproduction of both animals and plants.	
7.11	Analyze and interpret data to predict how environmental conditions (e.g., weather, availability of nutrients, location) and genetic factors (e.g., selective breeding of cattle or crops) influence the growth of organisms (e. g., drought decreasing plant growth, adequate supply of nutrients for maintaining normal plant growth, identical plant seeds growing at different rates in different weather conditions, fish growing larger in large ponds than in small ponds).	**L8.10a-**The characteristics of organisms are influenced by heredity and environment. **L8.10b-**For some characteristics, inheritance is more important (than environment); for other characteristics, interactions with the environment are more important (than heredity).
7.12	Construct and use models (e.g., monohybrid crosses using Punnett squares, diagrams, simulations) to explain that genetic variations between parent and offspring (e.g., different alleles, mutations) occur as a result of genetic differences in randomly inherited genes located on chromosomes and that additional variations may arise from alteration of genetic information.	
7.13	Construct an explanation from evidence to describe how genetic mutations result in harmful, beneficial, or neutral effects to the structure and function of an organism.	

7.14	Gather and synthesize information regarding the impact of technologies (e. g., hand pollination, selective breeding, genetic engineering, genetic modification, gene therapy) on the inheritance and/or appearance of desired traits in organisms.	
7.15	Analyze and interpret data for patterns of change in anatomical structures of organisms using the fossil record and the chronological order of fossil appearance in rock layers.	**L8.11d-**Fossils indicated that many organisms that lived long ago are extinct. **L8.11e-**Extinction of a species is common; most of the species that have lived on the Earth no longer exist.
7.16	Construct an explanation based on evidence (e.g., cladogram, phylogenetic tree) for the anatomical similarities and differences among modern organisms and between modern and fossil organisms, including living fossils (e.g., alligator, horseshoe crab, nautilus, coelacanth).	**L8.12a-**Similarities among organisms are found in anatomical features, which can be used to infer the degree of relatedness among organisms. **L8.12b-**In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance.
7.17	Obtain and evaluate pictorial data to compare patterns in the embryological development across multiple species to identify relationships not evident in the adult anatomy.	
7.18	Construct an explanation from evidence that natural selection acting over generations may lead to the predominance of certain traits that support successful survival and reproduction of a population and to the suppression of other traits.	**L8.11a-**Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. **L8.11b-**When an environment changes, the advantage or disadvantage of characteristics can change. **L8.11c-**Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival.

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Grade 8 Alabama Course of Study Standard**	**Grade 8 NAEP Content Statements**
8.1	Analyze patterns within the periodic table to construct models (e.g., molecular-level models, including drawings; computer representations) that illustrate the structure, composition, and characteristics of atoms and molecules.	**P8.3a-**All substances are composed of 1 or more of approximately 100 elements. **P8.3b-**The periodic table organizes the elements into families of elements with similar properties. **P8.4a-**Elements are a class of substances composed of a single kind of atom. **P8.4b-**Compounds are composed of two or more different elements. **P8.5b-**Metals and acids are examples of such classes. **P8.5c-**Metals are a class of elements that exhibit common physical properties such as conductivity and common chemical properties such as reacting with nonmetals to produce salts. **P12.2**-Electrons, protons, and neutrons are parts of the atom and have measureable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons. **P12.3-**In the Periodic Table, elements are arranges according to the number of protons (called the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements.

8.2	Plan and carry out investigations to generate evidence supporting the claim that one pure substance can be distinguished from another based on characteristic properties.	**P8.4c-**Each element and compound has physical and chemical properties, such as boiling point, density, color, and conductivity, which are independent of the amount of the sample. **P8.5a-**Substances are classified according to their physical and chemical properties. **P8.5d-**Acids are a class of compounds that exhibit common chemical properties, including a sour taste, characteristic color changes with litmus and other acid/base indicators, and the tendency to react with bases to produce salt and water.
8.3	Construct explanations based on evidence from investigations to differentiate among compounds, mixtures, and solutions.	**P8.4a-**Elements are a class of substances composed of a single kind of atom. **P8.4b-**Compounds are composed of two or more different elements. **P8.4c-**Each element and compound has physical and chemical properties, such as boiling point, density, color, and conductivity, which are independent of the amount of the sample.
8.3a	Collect and analyze information to illustrate how synthetic materials (e.g., medicine, food additives, alternative fuels, plastics) are derived from natural resources and how they impact society.	
8.4	Design and conduct an experiment to determine changes in particle motion, temperature, and state of a pure substance when thermal energy is added to or removed from a system.	**P8.1-**Properties of solids, liquids, and gases are explained by a model of matter that is composed of tiny particles in motion. **P8.6a-**Changes of state are explained by a model of matter composed of tiny particles that are in motion. **P8.6b-**When substances undergo changes of state, neither atoms nor molecules themselves are changed in structure. **P8.6c-**Mass is conserved when substances undergo changes of state. **P12.5-**Changes of state require a transfer of energy. Water has a very high specific heat, meaning it can absorb a large amount of energy while producing only small changes in temperature. **P12.8-**Atoms and molecules that compose matter are in constant motion (translational, rotational, or vibrational).

8.5	Observe and analyze characteristic properties of substances (e.g., odor, density, solubility, flammability, melting point, boiling point) before and after the substances combine to determine if a chemical reaction has occurred.	**P8.2-**Chemical properties of substances are explained by the arrangement of atoms and molecules. **P8.7a-**Chemical changes can occur when two substances, elements, or compounds react and produce one or more different substances whose physical and chemical properties are different from the reacting substances.
8.6	Create a model, diagram, or digital simulation to describe conservation of matter and mass in a chemical reaction and explain the resulting differences between products and reactants.	**P8.7b-**When substances undergo chemical change, the number and kinds of atoms in the reactants are the same as the number and kinds of atoms in the products. **P8.7c-**Mass is conserved when substances undergo chemical change.
8.7	Design, construct, and test a device (e.g., glow stick, hand warmer, hot or cold pack, thermal wrap) that either releases or absorbs thermal energy by chemical reactions (e.g., dissolving ammonium chloride or calcium chloride in water) and modify the device as needed based on criteria (e.g., amount/concentration, time, temperature).*	
8.8	Use Newton's first law to demonstrate and explain that an object is either at rest or moves at a constant velocity unless acted upon by an external force (e.g., model car on a table remaining at rest until pushed).	**P8.14a-**An object’s motion can be described by its speed and the direction in which it is moving. **P8.16a-**Forces have magnitude and direction. **P8.16b-**Forces can be added. **P8.16c-**The net force on an object is the sum of all the forces acting on the object. **P8.16d-**A nonzero net force on an object changes the object’s motion; that is; the object’s speed and/or direction of motion changes. **P8.16e-**A net force of zero on an object does not change the object’s motion; that is, the object remains at rest or continues to move at a constant speed in a straight line.

8.9	Use Newton's second law to demonstrate and explain how changes in an object's motion depend on the sum of the external forces on the object and the mass of the object (e.g., billiard balls moving when hit with a cue stick).	**P8.16a-**Forces have magnitude and direction. **P8.16b-**Forces can be added. **P8.16c-**The net force on an object is the sum of all the forces acting on the object. **P8.16d-**A nonzero net force on an object changes the object's motion; that is; the object's speed and/or direction of motion changes. **P8.16e-**A net force of zero on an object does not change the object's motion; that is, the object remains at rest or continues to move at a constant speed in a straight line.
8.10	Use Newton's third law to design a model to demonstrate and explain the resulting motion of two colliding objects (e.g., two cars bumping into each other, a hammer hitting a nail).*	**P8.16a-**Forces have magnitude and direction. **P8.16b-**Forces can be added. **P8.16c-**The net force on an object is the sum of all the forces acting on the object. **P8.16d-**A nonzero net force on an object changes the object's motion; that is; the object's speed and/or direction of motion changes. **P8.16e-**A net force of zero on an object does not change the object's motion; that is, the object remains at rest or continues to move at a constant speed in a straight line.
8.11	Plan and carry out investigations to evaluate how various factors (e.g., electric force produced between two charged objects at various positions; magnetic force produced by an electromagnet with varying number of wire turns, varying number or size of dry cells, and varying size of iron core) affect the strength of electric and magnetic forces.	**P12.10-**Electromagnetic waves are produced by changing the motion of charges or by changing magnetic fields. The energy of electromagnetic waves is transferred to matter in packets. The energy content of the packets is directly proportional to the frequency of the electromagnetic waves. **P12.23**-Electric force is a universal force that exists between any two charges objects. Opposite charges attract while like charges repel. The strength of the electric force is proportional to the magnitudes of the charges and inversely proportional to the square of the distance between them. Between any two charged particles, the electric force is vastly greater than the gravitational force.

8.12	Construct an argument from evidence explaining that fields exist between objects exerting forces on each other (e.g., interactions of magnets, electrically charged strips of tape, electrically charged pith balls, gravitational pull of the moon creating tides) even when the objects are not in contact.	**P8.15a-**Some forces between objects act when the objects are in direct contact or when they are not touching. **P8.15b-**Magnetic, electrical, and gravitational forces can act as a distance. **P12.22**-Gravitation is a universal attractive force that each mass exerts on any other mass. The strength of the gravitational force between two masses is proportional to the masses and inversely proportional to the square of the distance between them. **P12.23**-Electric force is a universal force that exists between any two charges objects. Opposite charges attract while like charges repel. The strength of the electric force is proportional to the magnitudes of the charges and inversely proportional to the square of the distance between them. Between any two charged particles, the electric force is vastly greater than the gravitational force.
8.13	Create and analyze graphical displays of data to illustrate the relationships of kinetic energy to the mass and speed of an object (e.g., riding a bicycle at different speeds, hitting a table tennis ball versus a golf ball, rolling similar toy cars with different masses down an incline).	**P8.14b-**An object's position can be measured and graphed as a function of time. **P8.14c-**An object's speed can be measured and graphed as a function of time.
8.14	Use models to construct an explanation of how a system of objects may contain varying types and amounts of potential energy (e.g., observing the movement of a roller coaster cart at various inclines, changing the tension in a rubber band, varying the number of batteries connected in a series, observing a balloon with static electrical charge being brought closer to a classmate's hair).	**P8.9a-**Three forms of potential energy are gravitational, elastic, and chemical. **P8.9b-**Gravitational potential energy changes in a system as the relative positions of objects are changed. **P8.9c-**Objects can have elastic potential energy due to their compression, or chemical potential energy due to the nature and arrangements of the atoms. **P12.13**-The potential energy of an object on Earth's surface is increased when the object's position is changed from one closer to Earth's surface to one father from Earth's surface.

8.15	Analyze and interpret data from experiments to determine how various factors affect energy transfer as measured by temperature (e.g., comparing final water temperatures after different masses of ice melt in the same volume of water with the same initial temperature, observing the temperature change of samples of different materials with the same mass and the same material with different masses when adding a specific amount of energy).	
8.16	Apply the law of conservation of energy to develop arguments supporting the claim that when the kinetic energy of an object changes, energy is transferred to or from the object (e.g., bowling ball hitting pins, brakes being applied to a car).	**P8.8a-**Objects and substances in motion have kinetic energy. **P8.8b-**For example, a moving baseball can break a window; water flowing down a stream moves pebbles and floating objects along with it. **P8.12a-**When energy is transferred from one system to another, the quantity of energy before the transfer equals the quantity of energy after transfer. **P8.12b-**For example, as an object falls, its potential energy decreases as its speed, and consequently, its kinetic energy increases. **P8.12c-**While an object is falling, some of the object's kinetic energy is transferred to the medium through which it falls, setting the medium into motion and heating it. **P12.16**-Total energy is conserved in a closed system.
8.17	Create and manipulate a model of a simple wave to predict and describe the relationships between wave properties (e.g., frequency, amplitude, wavelength) and energy.	**P8.10a-**Energy is transferred from place to place. **P8.10b-**Light energy from the Sun travels through space to Earth (radiation). **P8.10c-**Thermal energy travels from a flame through the metal of a cooking pan (conduction). **P8.10d-**Air warmed by a fireplace moves around a room (convection). **P8.10e-**Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter.

8.17a	Analyze and interpret data to illustrate an electromagnetic spectrum.	**P8.10e-**Waves (including sound and seismic waves, waves on water, and light waves) have energy and transfer energy when they interact with matter.
8.18	Use models to demonstrate how light and sound waves differ in how they are absorbed, reflected, and transmitted through different types of media.	
8.19	Integrate qualitative information to explain that common communication devices (e.g., cellular telephones, radios, remote controls, Wi-Fi components, global positioning systems [GPS], wireless technology components) use electromagnetic waves to encode and transmit information.	

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Physical Science (HS): Alabama Course of Study Standard**	**Grade 12 NAEP Content Statements**
HS.PS.1	Use the periodic table as a model to predict the relative properties and trends (e.g., reactivity of metals; types of bonds formed, including ionic, covalent, and polar covalent; numbers of bonds formed; reactions with oxygen) of main group elements based on the patterns of valence electrons in atoms.	**P12.3-**In the Periodic Table, elements are arranges according to the number of protons (called the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements. **P12.6-**An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called chemical bonds.
HS.PS.2	Plan and carry out investigations (e.g., squeezing a balloon, placing a balloon on ice) to identify the relationships that exist among the pressure, volume, density, and temperature of a confined gas.	
HS.PS.3	Analyze and interpret data from a simple chemical reaction or combustion reaction involving main group elements.	
HS.PS.4	Analyze and interpret data using acid-base indicators (e.g., color-changing markers, pH paper) to distinguish between acids and bases, including comparisons between strong and weak acids and bases.	**P12.7-**A large number of important reactions involve the transfer of either electrons (oxidation/reduction reactions) or hydrogen ions (Acid/base reactions between reacting ions, molecules, or atoms. In other chemical reactions, atoms interact with one another by sharing electrons to create a bond. An important example is carbon atoms, which can bond to one another in chains, rings, and branching networks to form, along with other kinds of atoms (Hydrogen, oxygen, nitrogen, and sulfur), a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.
HS.PS.5	Use mathematical representations to support and verify the claim that atoms, and therefore mass, are conserved during a simple chemical reaction.	
HS.PS.6	Develop models to illustrate the concept of half-life for radioactive decay.	
HS.PS.6.a	Research and communicate information about types of naturally occurring radiation and their properties.	**P12.11-**Fission and fusion are reactions involving changes in the nuclei of atoms. Fission is the splitting of a large nucleus into smaller nuclei and particles. Fusion involves joining two relatively light nuclei at extremely high temperature and pressure. Fusion is the process responsible for the energy of the Sun and other stars.

HS.PS.6.b	Develop arguments for and against nuclear power generation compared to other types of power generation.	**P12.11**-Fission and fusion are reactions involving changes in the nuclei of atoms. Fission is the splitting of a large nucleus into smaller nuclei and particles. Fusion involves joining two relatively light nuclei at extremely high temperature and pressure. Fusion is the process responsible for the energy of the Sun and other stars. **P12.15**-Nuclear reactions (Fission and fusion) convert very small amount of matter into appreciable amounts of energy.
HS.PS.7	Analyze and interpret data for one- and two-dimensional motion applying basic concepts of distance, displacement, speed, velocity, and acceleration (e.g., velocity versus time graphs, displacement versus time graphs, acceleration versus time graphs).	**P12.17**-The motion of an object can be described by its position and velocity as functions of time and by its average speed and average acceleration during intervals of time.
HS.PS.8	Apply Newton's laws to predict the motion of a system by constructing force diagrams that identify the external forces acting on the system, including friction (e.g., a book on a table, an object being pushed across a floor, an accelerating car).	
HS.PS.9	Use mathematical equations (e.g., (m1v1 + m2v2) before = (m1v1 + m2v2) after) and diagrams to explain that the total momentum of a system of objects is conserved when there is no net external force on the system.	**P12.21**-Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted by the second object back on the first object. In closed systems, momentum is the quantity of motion that is conserved. Conservation of momentum can be used to help validate the relationship a=Fnet/m.
HS.PS.9.a	Use the laws of conservation of mechanical energy and momentum to predict the result of one-dimensional elastic collisions.	**P12.9**-Energy may be transferred from one object to another during collisions. **P12.21**-Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted by the second object back on the first object. In closed systems, momentum is the quantity of motion that is conserved. Conservation of momentum can be used to help validate the relationship a=Fnet/m.
HS.PS.10	Construct simple series and parallel circuits containing resistors and batteries and apply Ohm's law to solve typical problems demonstrating the effect of changing values of resistors and voltages.	
HS.PS.11	Design and conduct investigations to verify the law of conservation of energy, including transformations of potential energy, kinetic energy, thermal energy, and the effect of any work performed on or by the system.	**P12.9**-Energy may be transferred from one object to another during collisions. **P12.13**-The potential energy of an object on Earth's surface is increased when the object's position is changed from one closer to Earth's surface to one father from Earth's surface. **P12.16**-Total energy is conserved in a closed system.

HS.PS.12	Design, build, and test the ability of a device (e.g., Rube Goldberg devices, wind turbines, solar cells, solar ovens) to convert one form of energy into another form of energy.	
HS.PS.13	Use mathematical representations to demonstrate the relationships among wavelength, frequency, and speed of waves (e.g., the relation $v = \lambda f$) traveling in various media (e.g., electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, seismic waves traveling through Earth).	**P12.10**-Electromagnetic waves are produced by changing the motion of charges or by changing magnetic fields. The energy of electromagnetic waves is transferred to matter in packets. The energy content of the packets is directly proportional to the frequency of the electromagnetic waves.
HS.PS.14	Propose and defend a hypothesis based on information gathered from published materials (e.g., trade books, magazines, Internet resources, videos) for and against various claims for the safety of electromagnetic radiation.	**P12.10**-Electromagnetic waves are produced by changing the motion of charges or by changing magnetic fields. The energy of electromagnetic waves is transferred to matter in packets. The energy content of the packets is directly proportional to the frequency of the electromagnetic waves.
HS.PS.15	Obtain and communicate information from published materials to explain how transmitting and receiving devices (e.g., cellular telephones, medical-imaging technology, solar cells, wireless Internet, scanners, Sound Navigation and Ranging [SONAR]) use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Biology: Alabama Course of Study Standard**	**Grade 12 NAEP Content Statements**
B.1	Use models to compare and contrast how the structural characteristics of carbohydrates, nucleic acids, proteins, and lipids define their function in organisms.	**L12.1-**Living systems are made of complex molecules (including carbohydrates, fats, proteins, and nucleic acids) that consist mostly of a few elements, especially carbon, hydrogen, oxygen, nitrogen, and phosphorous. **L12.2**-Cellular processes are carried out by many different types of molecules, mostly proteins. Protein molecules are long, usually folded chains made from combinations of amino-acid molecules. Protein molecules assemble fats and carbohydrates and carry out other cellular functions. The function of each protein molecule depends on its specific sequence of amino acids and the shape of the molecule. **L12.4-**Plants have the capability (through photosynthesis) to take energy from light to form higher energy sugar molecules containing carbon, hydrogen, and oxygen from lower energy molecules. These sugar molecules can be used to make amino acids and other carbon-containing (organic) molecules and assembled into larger molecules with biological activity (including proteins, DNA, carbohydrates, and fats).
B.2	Obtain, evaluate, and communicate information to describe the function and diversity of organelles and structures in various types of cells (e.g., muscle cells having a large amount of mitochondria, plasmids in bacteria, chloroplasts in plant cells).	**L12.3-**Cellular processes are regulated both internally and externally by environments in which cells exist, including local environments that lead to cell differentiation during the development of multicellular organisms. During the development of complex multicellular organisms, cell differentiation is regulated through the expression of different genes.
B.3	3. Formulate an evidence-based explanation regarding how the composition of deoxyribonucleic acid (DNA) determines the structural organization of proteins. a. Obtain and evaluate experiments of major scientists and communicate their contributions to the development of the structure of DNA and to the development of the central dogma of molecular biology. b. Obtain, evaluate, and communicate information that explains how advancements in genetic technology (e.g., Human Genome Project, Encyclopedia of DNA Elements [ENCODE] project, 1000 Genomes Project) have contributed to the understanding as to how a genetic change at the DNA level may affect proteins and, in turn, influence the appearance of traits. c. Obtain information to identify errors that occur during DNA replication (e.g., deletion, insertion, translocation, substitution, inversion, frame-shift, point mutations).	**L12.9-**The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. Genes are segments of DNA molecules. Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.

B.4	Develop and use models to explain the role of the cell cycle during growth and maintenance in multicellular organisms (e.g., normal growth and/or uncontrolled growth resulting in tumors).	**L12.3-**Cellular processes are regulated both internally and externally by environments in which cells exist, including local environments that lead to cell differentiation during the development of multicellular organisms. During the development of complex multicellular organisms, cell differentiation is regulated through the expression of different genes.
B.5	Plan and carry out investigations to explain feedback mechanisms (e.g., sweating and shivering) and cellular processes (e.g., active and passive transport) that maintain homeostasis. a. Plan and carry out investigations to explain how the unique properties of water	
B.6	Analyze and interpret data from investigations to explain the role of products and reactants of photosynthesis and cellular respiration in the cycling of matter and the flow of energy. a. Plan and carry out investigations to explain the interactions among pigments, absorption of light, and reflection of light.	**L12.4-**Plants have the capability (through photosynthesis) to take energy from light to form higher energy sugar molecules containing carbon, hydrogen, and oxygen from lower energy molecules. These sugar molecules can be used to make amino acids and other carbon-containing (organic) molecules and assembled into larger molecules with biological activity (including proteins, DNA, carbohydrates, and fats). **L12.5-**Plants have the capability (through photosynthesis) to take energy from light to form higher energy sugar molecules containing carbon, hydrogen, and oxygen from lower energy molecules. These sugar molecules can be used to make amino acids and other carbon-containing (organic) molecules and assembled into larger molecules with biological activity (including proteins, DNA, carbohydrates, and fats).
B.7	Develop and use models to illustrate examples of ecological hierarchy levels, including biosphere, biome, ecosystem, community, population, and organism.	**L12.7-**Although the interrelationships and interdependence of organisms may generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution. The impact of the human species has major consequences for other species.
B.8	Develop and use models to describe the cycling of matter (e.g., carbon, nitrogen, water) and flow of energy (e.g., food chains, food webs, biomass pyramids, ten percent law) between abiotic and biotic factors in ecosystems.	**L12.5-**Plants have the capability (through photosynthesis) to take energy from light to form higher energy sugar molecules containing carbon, hydrogen, and oxygen from lower energy molecules. These sugar molecules can be used to make amino acids and other carbon-containing (organic) molecules and assembled into larger molecules with biological activity (including proteins, DNA, carbohydrates, and fats). **L12.6-**As matter cycles and energy flows through different levels of organization of living systems (cells, organs, organisms, communities) and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.

B.9	Use mathematical comparisons and visual representations to support or refute explanations of factors that affect population growth (e.g., exponential, linear, logistic).	**L12.7-**Although the interrelationships and interdependence of organisms may generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution. The impact of the human species has major consequences for other species.
B.10	Construct an explanation and design a real-world solution to address changing conditions and ecological succession caused by density-dependent and/or density-independent factors.*	
B.11	Analyze and interpret data collected from probability calculations to explain the variation of expressed traits within a population. a. Use mathematics and computation to predict phenotypic and genotypic ratios and percentages by constructing Punnett squares, including using both homozygous and heterozygous allele pairs. b. Develop and use models to demonstrate codominance, incomplete dominance, and Mendel's laws of segregation and independent assortment. c. Analyze and interpret data (e.g., pedigree charts, family and population studies) regarding Mendelian and complex genetic disorders (e.g., sickle-cell anemia, cystic fibrosis, type 2 diabetes) to determine patterns of genetic inheritance and disease risks from both genetic and environmental factors.	**L12.8-**Hereditary information is contained in genes, which are located in the chromosomes of each cell. A human cell contains many thousands of different genes. One or many genes can determine an inherited trait of an individual, and a single gene can influence more than one trait. **L12.9-**The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. Genes are segments of DNA molecules. Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment. **L12.10**-Sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents.
B.12	Develop and use a model to analyze the structure of chromosomes and how new genetic combinations occur through the process of meiosis. a. Analyze data to draw conclusions about genetic disorders caused by errors in meiosis (e.g., Down syndrome, Turner syndrome).	**L12.8-**Hereditary information is contained in genes, which are located in the chromosomes of each cell. A human cell contains many thousands of different genes. One or many genes can determine an inherited trait of an individual, and a single gene can influence more than one trait. **L12.9**-The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. Genes are segments of DNA molecules. Inserting, deleting, or substituting DNA segments can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment. **L12.10**-Sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents.

B.13	Obtain, evaluate, and communicate information to explain how organisms are classified by physical characteristics, organized into levels of taxonomy, and identified by binomial nomenclature (e.g., taxonomic classification, dichotomous keys). a. Engage in argument to justify the grouping of viruses in a category separate from living things.	
B.14	Analyze and interpret data to evaluate adaptations resulting from natural and artificial selection that may cause changes in populations over time (e. g., antibiotic-resistant bacteria, beak types, peppered moths, pest-resistant crops).	**L12.12-**Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched. **L12.13-**Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection from environmental pressure of those organisms better able to survive and leave offspring.
B.15	Engage in argument from evidence (e.g., mathematical models such as distribution graphs) to explain how the diversity of organisms is affected by overpopulation of species, variation due to genetic mutations, and competition for limited resources.	**L12.11-**Modern ideas about evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms. **L12.13-**Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection from environmental pressure of those organisms better able to survive and leave offspring.
B.16	Analyze scientific evidence (e.g., DNA, fossil records, cladograms, biogeography) to support hypotheses of common ancestry and biological evolution.	**L12.11-**Modern ideas about evolution (including natural selection and common descent) provide a scientific explanation for the history of life on Earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms. **L12.12**-Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descent branched.

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Chemistry: Alabama Course of Study Standard**	**Grade 12 NAEP Content Statements**
Chm.1	Obtain and communicate information from historical experiments (e.g., work by Mendeleev and Moseley, Rutherford's gold foil experiment, Thomson's cathode ray experiment, Millikan's oil drop experiment, Bohr's interpretation of bright line spectra) to determine the structure and function of an atom and to analyze the patterns represented in the periodic table.	**P12.2**-Electrons, protons, and neutrons are parts of the atom and have measureable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.
Chm.2	Develop and use models of atomic nuclei to explain why the abundance-weighted average of isotopes of an element yields the published atomic mass.	**P12.4**-In a neutral atom, the positively charged nucleus is surrounded by the same number of negatively charged electrons. Atoms of an element whose nuclei have different numbers of neutrons are called isotopes.
Chm.3	Use the periodic table as a systematic representation to predict properties of elements based on their valence electron arrangement.	**P12.6**-An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called chemical bonds.
Chm.3.a	Analyze data such as physical properties to explain periodic trends of the elements, including metal/nonmetal/metalloid behavior, electrical/heat conductivity, electronegativity and electron affinity, ionization energy, and atomic-covalent/ionic radii, and how they relate to position in the periodic table.	
Chm.3.b	Develop and use models (e.g., Lewis dot, 3-D ball-and-stick, space-filling, valence-shell electron-pair repulsion [VSEPR]) to predict the type of bonding and shape of simple compounds.	**P12.6**-An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called chemical bonds.
Chm.3.c	Use the periodic table as a model to derive formulas and names of ionic and covalent compounds.	
Chm.4	Plan and conduct an investigation to classify properties of matter as intensive (e.g., density, viscosity, specific heat, melting point, boiling point) or extensive (e.g., mass, volume, heat) and demonstrate how intensive properties can be used to identify a compound.	
Chm.5	Plan and conduct investigations to demonstrate different types of simple chemical reactions based on valence electron arrangements of the reactants and determine the quantity of products and reactants.	**P12.6**-An atom's electron configuration, particularly of the outermost electrons, determines how the atom can interact with other atoms. The interactions between atoms that hold them together in molecules or between oppositely charged ions are called chemical bonds.
Chm.5.a	Use mathematics and computational thinking to represent the ratio of reactants and products in terms of masses, molecules, and moles.	
Chm.5.b	Use mathematics and computational thinking to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	

Chm.6	Use mathematics and computational thinking to express the concentrations of solutions quantitatively using molarity.	
Chm.6.a	Develop and use models to explain how solutes are dissolved in solvents.	
Chm.6.b	Analyze and interpret data to explain effects of temperature on the solubility of solid, liquid, and gaseous solutes in a solvent and the effects of pressure on the solubility of gaseous solutes.	**P12.1**-Differences in the physical properties of solids, liquids, and gases are explained by the ways in which the atoms, ions, or molecules of the substances are arranged and the strength of the forces of attraction between the atoms, ions, of molecules.
Chm.6.c	Design and conduct experiments to test the conductivity of common ionic and covalent substances in a solution.	
Chm.6.d	Use the concept of pH as a model to predict the relative properties of strong, weak, concentrated, and dilute acids and bases (e.g., Arrhenius and Brønsted-Lowry acids and bases).	**P12.7**-A large number of important reactions involve the transfer of either electrons (oxidation/reduction reactions) or hydrogen ions (Acid/base reactions between reacting ions, molecules, or atoms. In other chemical reactions, atoms interact with one another by sharing electrons to create a bond. An important example is carbon atoms, which can bond to one another in chains, rings, and branching networks to form, along with other kinds of atoms (Hydrogen, oxygen, nitrogen, and sulfur), a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.
Chm.7	Plan and carry out investigations to explain the behavior of ideal gases in terms of pressure, volume, temperature, and number of particles.	
Chm7a	Use mathematics to describe the relationships among pressure, temperature, and volume of an enclosed gas when only the amount of gas is constant.	
Chm.7.b	Use mathematical and computational thinking based on the ideal gas law to determine molar quantities.	
Chm.8	Refine the design of a given chemical system to illustrate how LeChâtelier' s principle affects a dynamic chemical equilibrium when subjected to an outside stress (e.g., heating and cooling a saturated sugar-water solution).	
Chm.9	Analyze and interpret data (e.g., melting point, boiling point, solubility, phase-change diagrams) to compare the strength of intermolecular forces and how these forces affect physical properties and changes.	**P12.1**-Differences in the physical properties of solids, liquids, and gases are explained by the ways in which the atoms, ions, or molecules of the substances are arranged and the strength of the forces of attraction between the atoms, ions, of molecules. **P12.12**-Heating increases the translational, rotational, and vibrational energy of the atoms composing elements and the molecules or ions composing compounds. At the translational energy of the atoms, molecules, or ions increases, the temperature of the matter increases. Heating a sample of a crystalline solid increases the vibrational energy of the atoms, molecules, or ions. When the vibrational energy becomes great enough, the crystalline structure breaks down and the solid melts.

Chm.10	Plan and conduct experiments that demonstrate how changes in a system (e. g., phase changes, pressure of a gas) validate the kinetic molecular theory.	**P12.12**-Heating increases the translational, rotational, and vibrational energy of the atoms composing elements and the molecules or ions composing compounds. At the translational energy of the atoms, molecules, or ions increases, the temperature of the matter increases. Heating a sample of a crystalline solid increases the vibrational energy of the atoms, molecules, or ions. When the vibrational energy becomes great enough, the crystalline structure breaks down and the solid melts.
Chm.10.a	Develop a model to explain the relationship between the average kinetic energy of the particles in a substance and the temperature of the substance (e.g., no kinetic energy equaling absolute zero [0K or -273.15oC]).	**P12.8**-Atoms and molecules that compose matter are in constant motion (translational, rotational, or vibrational).
Chm.11	Construct an explanation that describes how the release or absorption of energy from a system depends upon changes in the components of the system.	**P12.16**-Total energy is conserved in a closed system.
Chm.11.a	Develop a model to illustrate how the changes in total bond energy determine whether a chemical reaction is endothermic or exothermic.	**P12.14**-Chemical reactions either release energy to the environment (exothermic) or absorb energy from the environment(Endothermic).
Chm.11.b	Plan and conduct an investigation that demonstrates the transfer of thermal energy in a closed system (e.g., using heat capacities of two components of differing temperatures).	**P12.5**-Changes of state require a transfer of energy. Water has a very high specific heat, meaning it can absorb a large amount of energy while producing only small changes in temperature.

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Physics: Alabama Course of Study Standard**	**Grade 12 NAEP Content Statements**
Phy.1	Investigate and analyze, based on evidence obtained through observation or experimental design, the motion of an object using both graphical and mathematical models (e.g., creating or interpreting graphs of position, velocity, and acceleration versus time graphs for one- and two-dimensional motion; solving problems using kinematic equations for the case of constant acceleration) that may include descriptors such as position, distance traveled, displacement, speed, velocity, and acceleration.	**P12.17**-The motion of an object can be described by its position and velocity as functions of time and by its average speed and average acceleration during intervals of time. **P12.19**-The motion of an object changes only when a net force is applied. **P12.22**-Gravitation is a universal attractive force that each mass exerts on any other mass. The strength of the gravitational force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.
Phy.2	Identify external forces in a system and apply Newton's laws graphically by using models such as free-body diagrams to explain how the motion of an object is affected, ranging from simple to complex, and including circular motion.	**P12.19**-The motion of an object changes only when a net force is applied. **P12.20**-The magnitude of acceleration of an object depends directly on the strength of the net force and inversely on the mass of the object. This relationship (a=Fnet/m) is independent of the nature of the force.
Phy.2.a	Use mathematical computations to derive simple equations of motion for various systems using Newton's second law.	**P12.20-**The magnitude of acceleration of an object depends directly on the strength of the net force and inversely on the mass of the object. This relationship (a=Fnet/m) is independent of the nature of the force.
Phy.2.b	Use mathematical computations to explain the nature of forces (e.g., tension, friction, normal) related to Newton's second and third laws.	
Phy.3	Evaluate qualitatively and quantitatively the relationship between the force acting on an object, the time of interaction, and the change in momentum using the impulse-momentum theorem.	**P12.21**-Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted by the second object back on the first object. In closed systems, momentum is the quantity of motion that is conserved. Conservation of momentum can be used to help validate the relationship a=Fnet/m.
Phy.4	Identify and analyze forces responsible for changes in rotational motion and develop an understanding of the effect of rotational inertia on the motion of a rotating object (e.g., merry-go-round, spinning toy, spinning figure skater, stellar collapse [supernova], rapidly spinning pulsar).	

Phy.5	Construct models that illustrate how energy is related to work performed on or by an object and explain how different forms of energy are transformed from one form to another (e.g., distinguishing between kinetic, potential, and other forms of energy such as thermal and sound; applying both the work-energy theorem and the law of conservation of energy to systems such as roller coasters, falling objects, and spring-mass systems; discussing the effect of frictional forces on energy conservation and how it affects the motion of an object).	**P12.13**-The potential energy of an object on Earth's surface is increased when the object's position is changed from one closer to Earth's surface to one father from Earth's surface.
Phy.6	Investigate collisions, both elastic and inelastic, to evaluate the effects on momentum and energy conservation.	**P12.9**-Energy may be transferred from one object to another during collisions. **P12.21**-Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted by the second object back on the first object. In closed systems, momentum is the quantity of motion that is conserved. Conservation of momentum can be used to help validate the relationship a=Fnet/m.
Phy.7	Plan and carry out investigations to provide evidence that the first and second laws of thermodynamics relate work and heat transfers to the change in internal energy of a system with limits on the ability to do useful work (e.g., heat engine transforming heat at high temperature into mechanical energy and low-temperature waste heat, refrigerator absorbing heat from the cold reservoir and giving off heat to the hot reservoir with work being done).	
Phy.7.a	Develop models to illustrate methods of heat transfer by conduction (e.g., an ice cube in water), convection (e.g., currents that transfer heat from the interior up to the surface), and radiation (e.g., an object in sunlight).	
Phy.7.b	Engage in argument from evidence regarding how the second law of thermodynamics applies to the entropy of open and closed systems.	
Phy.8	Investigate the nature of wave behavior to illustrate the concept of the superposition principle responsible for wave patterns, constructive and destructive interference, and standing waves (e.g., organ pipes, tuned exhaust systems).	
Phy.8.a	Predict and explore how wave behavior is applied to scientific phenomena such as the Doppler effect and Sound Navigation and Ranging (SONAR).	

Phy.9	Obtain and evaluate information regarding technical devices to describe wave propagation of electromagnetic radiation and compare it to sound propagation. (e.g., wireless telephones, magnetic resonance imaging [MRI], microwave systems, Radio Detection and Ranging [RADAR], SONAR, ultrasound).	
Phy.10	Plan and carry out investigations that evaluate the mathematical explanations of light as related to optical systems (e.g., reflection, refraction, diffraction, intensity, polarization, Snell's law, the inverse square law).	
Phy.11	Develop and use models to illustrate electric and magnetic fields, including how each is created (e.g., charging by either conduction or induction and polarizing; sketching field lines for situations such as point charges, a charged straight wire, or a current carrying wires such as solenoids; calculating the forces due to Coulomb's laws), and predict the motion of charged particles in each field and the energy required to move a charge between two points in each field.	**P12.23**-Electric force is a universal force that exists between any two charges objects. Opposite charges attract while like charges repel. The strength of the electric force is proportional to the magnitudes of the charges and inversely proportional to the square of the distance between them. Between any two charged particles, the electric force is vastly greater than the gravitational force.
Phy.12	Use the principles of Ohm's and Kirchhoff's laws to design, construct, and analyze combination circuits using typical components (e.g., resistors, capacitors, diodes, sources of power).	

2015 Alabama Course of Study: Science and NAEP Standards Correlation			
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.			
COS#	**Earth and Space Science: Alabama Course of Study Standard**	**Grade 8 NAEP Content Statements**	**Grade 12 NAEP Content Statements**
ESS.1	Develop and use models to illustrate the lifespan of the sun, including energy released during nuclear fusion that eventually reaches Earth through radiation.	**E8.11a**-The Sun is the major source of energy for phenomena on Earth's surface	**E12.3a**-Stars, like the Sun, transform matter into energy in nuclear reactions. **E12.9a**-Earth systems have internal and external sources of energy, both of which create heat. **E12.9b**-The Sun is the major external source of energy.
ESS.2	Engage in argument from evidence to compare various theories for the formation and changing nature of the universe and our solar system (e.g., Big Bang Theory, Hubble' s law, steady state theory, light spectra, motion of distant galaxies, composition of matter in the universe).		**E12.1**-The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin approximately 13.7 billion years ago when the universe began in a hot, dense state. According to this theory, the universe has been expanding ever since. **E12.5**-Theories of planet formation and radioactive dating of meterorites and lunar samples have led to the conclusion that the Sun, Earth, and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago.
ESS.3	Evaluate and communicate scientific information (e.g., Hertzsprung-Russell diagram) in reference to the life cycle of stars using data of both atomic emission and absorption spectra of stars to make inferences about the presence of certain elements.		**E12.3**-Stars, like the Sun, transform matter into energy in nuclear reactions. When hydrogen nuclei fuse to form helium, a small amount of matter is converted to energy. These and other processes in stars have led to the formation of all the other elements. **E12.2**-Early in the history of the universe, matter (primarily the light atoms hydrogen and helium) clumped together by gravitational attraction to form countless trillions of stars and biollions of galaxies.

ESS.4	Apply mathematics and computational thinking in reference to Kepler's laws, Newton's laws of motion, and Newton's gravitational laws to predict the orbital motion of natural and man-made objects in the solar system.		
ESS.5	Use mathematics to explain the relationship of the seasons to the tilt of Earth's axis (e.g., zenith angle, solar angle, surface area) and its revolution about the sun, addressing intensity and distribution of sunlight on Earth' s surface.		
ESS.6	Obtain and evaluate information about Copernicus, Galileo, Kepler, Newton, and Einstein to communicate how their findings challenged conventional thinking and allowed for academic advancements and space exploration.		
ESS.7	Analyze and interpret evidence regarding the theory of plate tectonics, including geologic activity along plate boundaries and magnetic patterns in undersea rocks, to explain the ages and movements of continental and oceanic crusts.		**E12.8**-Mapping of the Mid-Atlantic Ridge, evidence of sea floor spreading, and subduction provided crucial evidentce in support of the theory of plate tectonics. The theory currently explains plate motion as follows: the outward transfer of Earth's internal heat propels the plates comprising Earth's surface across the face of the globe. Plates are pushed apart where magma rises to form midocean ridges, and the edges of plates are pulled back down where Earth materials sink into the crust at deep trenches.

ESS.8	Develop a time scale model of Earth's biological and geological history to establish relative and absolute age of major events in Earth's history (e.g., radiometric dating, models of geologic cross sections, sedimentary layering, fossilization, early life forms, folding, faulting, igneous intrusions).		**E12.4**-Early methods of determining geologic time, such as the use of index fossils and stratigraphic sequences, allowed for the relative dating of geological events. However, absolute dating was impossible until the discovery that certain radioactive isotopes in rocks have known decay rates, making it possible to determine how many years ago a given rock sample formed. **E12.6**-Early Earth was very differenct from today's planet. Evidence for once-celled forms of life (bacteria) extends back more than 3.5 billion years. The vevolutoin of life caused dramatic changes in the composition of Earth's atmosphere, which did not originally contain molecular oxygen. **E12.7**-Earth's current structure has been influenced by both sporadic and gradual events. Changes caused by violent earthquakes and volcanic eruptions can be observed on a human time scale; however, many geological processes, such as the building of mountain chains and shifting of entire continents, take place over hundreds of millions of years.
ESS.9	Obtain, evaluate, and communicate information to explain how constructive and destructive processes (e.g., weathering, erosion, volcanism, orogeny, plate tectonics, tectonic uplift) shape Earth's land features (e. g., mountains, valleys, plateaus) and sea features (e.g., trenches, ridges, seamounts).		**E12.7**-Earth's current structure has been influenced by both sporadic and gradual events. Changes caused by violent earthquakes and volcanic eruptions can be observed on a human time scale; however, many geological processes, such as the building of mountain chains and shifting of entire continents, take place over hundreds of millions of years.

ESS.10	Construct an explanation from evidence for the processes that generate the transformation of rocks in Earth's crust, including chemical composition of minerals and characteristics of sedimentary, igneous, and metamorphic rocks.	**E8.6**-Soil consists of weathered rocks and decomposed organic material from dead plants, animals, and bacteria. Soils are often found in layers with each having a different chemical composition and texture.	**E.12.12**-Movement of matter throug Earth's systems is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example, occurs in carbonate ocks such as limesone, in coal and other fissil fuels, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.
ESS.11	Obtain and communicate information about significant geologic characteristics (e.g., types of rocks and geologic ages, earthquake zones, sinkholes, caves, abundant fossil fauna, mineral and energy resources) that impact life in Alabama and the southeastern United States.		
ESS.12	Develop a model of Earth's layers using available evidence to explain the role of thermal convection in the movement of Earth' s materials (e.g., seismic waves, movement of tectonic plates).		
ESS.13	Analyze and interpret data of interactions between the hydrologic and rock cycles to explain the mechanical impacts (e.g., stream transportation and deposition, erosion, frost-wedging) and chemical impacts (e.g., oxidation, hydrolysis, carbonation) of Earth materials by water's properties.		
ESS.14	Construct explanations from evidence to describe how changes in the flow of energy through Earth's systems (e.g., volcanic eruptions, solar output, ocean circulation, surface temperatures, precipitation patterns, glacial ice volumes, sea levels, Coriolis effect) impact the climate.		**E12.10a**-Climate is determined by energy transfer from the Sun at and near Earth's surface. **E12.10b**-This energy transfer is influenced by dynamic processes such as cloud cover, stmospheric gases, and Earth's rotation, as well as static conditions such as the positions of mountain ranges, oceans, seas, and lakes.

ESS.15	Obtain, evaluate, and communicate information to verify that weather (e.g., temperature, relative humidity, air pressure, dew point, adiabatic cooling, condensation, precipitation, winds, ocean currents, barometric pressure, wind velocity) is influenced by energy transfer within and among the atmosphere, lithosphere, biosphere, and hydrosphere.		**E12.10b**-This energy transfer is influenced by dynamic processes such as cloud cover, atmospheric gases, and Earth's rotation, as well as static conditions such as the positions of mountain ranges, oceans, seas, and lakes.
ESS.15.a	Analyze patterns in weather data to predict various systems, including fronts and severe storms.		
ESS.15.b	Use maps and other visualizations to analyze large data sets that illustrate the frequency, magnitude, and resulting damage from severe weather events in order to predict the likelihood and severity of future events.		

2015 Alabama Course of Study: Science and NAEP Standards Correlation		
The NAEP content statements identify content that could be included in lessons building toward mastery of the correlating standards from the 2015 Alabama Course of Study: Science. Please visit the Alabama Insight Tool on ALEX to see the standards unpacked in detail.		
COS#	**Environmental Science: Alabama Course of Study Standard**	**Grade 12 NAEP Content Statements**
ES.1	Investigate and analyze the use of nonrenewable energy sources (e.g., fossil fuels, nuclear, natural gas) and renewable energy sources (e.g., solar, wind, hydroelectric, geothermal) and propose solutions for their impact on the environment.	
ES.2	Use models to illustrate and communicate the role of photosynthesis and cellular respiration as carbon cycles through the biosphere, atmosphere, hydrosphere, and geosphere.	
ES.3	Use mathematics and graphic models to compare factors affecting biodiversity and populations in ecosystems.	
ES.4	Engage in argument from evidence to evaluate how biological or physical changes within ecosystems (e.g., ecological succession, seasonal flooding, volcanic eruptions) affect the number and types of organisms, and that changing conditions may result in a new or altered ecosystem.	**L12.7-**Although the interrelationships and interdependence of organisms may generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution. The impact of the human species has major consequences for other species.
ES.5	Engage in argument from evidence to compare how individual versus group behavior (e.g., flocking; cooperative behaviors such as hunting, migrating, and swarming) may affect a species' chance to survive and reproduce over time.	
ES.6	Obtain, evaluate, and communicate information to describe how human activity may affect biodiversity and genetic variation of organisms, including threatened and endangered species.	**L12.7-**Although the interrelationships and interdependence of organisms may generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution. The impact of the human species has major consequences for other species.
ES.7	Analyze and interpret data to investigate how a single change on Earth's surface may cause changes to other Earth systems (e.g., loss of ground vegetation causing an increase in water runoff and soil erosion).	
ES.8	Engage in an evidence-based argument to explain how, over time, Earth's systems affect the biosphere and the biosphere affects Earth's systems (e.g., microbial life increasing the formation of soil; corals creating reefs that alter patterns of erosion and deposition along coastlines).	
ES.9	Develop and use models to trace the flow of water, nitrogen, and phosphorus through the hydrosphere, atmosphere, geosphere, and biosphere.	

ES.10	Design solutions for protection of natural water resources (e.g., bioassessment, methods of water treatment and conservation) considering properties, uses, and pollutants (e.g., eutrophication, industrial effluents, agricultural runoffs, point and nonpoint pollution resources).*	
ES.11	Engage in argument from evidence to defend how coastal, marine, and freshwater sources (e.g., estuaries, marshes, tidal pools, wetlands, beaches, inlets, rivers, lakes, oceans, coral reefs) support biodiversity, economic stability, and human recreation.	
ES.12	Analyze and interpret data and climate models to predict how global or regional climate change can affect Earth's systems (e.g., precipitation and temperature and their associated impacts on sea level, glacial ice volumes, and atmosphere and ocean composition).	
ES.13	Obtain, evaluate, and communicate information based on evidence to explain how key natural resources (e.g., water sources, fertile soils, concentrations of minerals and fossil fuels), natural hazards, and climate changes influence human activity (e.g., mass migrations).	
ES.14	Analyze cost-benefit ratios of competing solutions for developing, conserving, managing, recycling, and reusing energy and mineral resources to minimize impacts in natural systems (e.g., determining best practices for agricultural soil use, mining for coal, and exploring for petroleum and natural gas sources).*	
ES.15	Construct an explanation based on evidence to determine the relationships among management of natural resources, human sustainability, and biodiversity (e.g., resources, waste management, per capita consumption, agricultural efficiency, urban planning).	
ES.16	Obtain and evaluate information from published results of scientific computational models to illustrate the relationships among Earth's systems and how these relationships may be impacted by human activity (e.g., effects of an increase in atmospheric carbon dioxide on photosynthetic biomass, effect of ocean acidification on marine populations).	
ES.17	Obtain, evaluate, and communicate geological and biological information to determine the types of organisms that live in major biomes.	
ES.17.a	Analyze and interpret data collected through geographic research and field investigations (e.g., relief, topographic, and physiographic maps; rivers; forest types; watersheds) to describe the biodiversity by region for the state of Alabama (e.g., terrestrial, freshwater, marine, endangered, invasive).	