



Science Curriculum

Kearney Public Mission Statement

Create an environment that fosters mutual respect

Inspire the love of learning

Expect Excellence from all

Kearney Public Schools Science Purpose Statement

The Kearney Public Schools science curricular mission is to empower students with the knowledge, application and inquiry skills inherent in becoming responsible and contributing citizens in an evolving technological world.

Kindergarten Science

INQUIRY AND NATURE OF SCIENCE: Abilities to Do Scientific Inquiry

SC.K.1 The kindergarten students will apply scientific inquiry to evaluate the world around them.

State Standards (2.1.1.a, 2.1.1.b, 2.1.1.c, 2.1.1.d, 2.1.1.e)

- Scientific Questioning – Ask questions that relate to a science topic.
- Scientific Investigations – Conduct simple investigations.
- Scientific Tools – Select and safely use simple tools appropriately.
- Scientific Observations – Describe objects, organisms, or events using words and numbers.
- Scientific Data Collections – Collect and record observations.

PHYSICAL SCIENCE: Matter

SC.K.2 Students will categorize matter according to their properties and their behavior.

State Standard (2.2.3)

- Students will observe and describe physical properties of objects (e.g. freezing and melting, sinking and floating)
- Students will sort objects by their physical attributes (e.g. color, size, texture, shape, weight)
- Students will measure objects using non-standard units and classify the objects into groups (e.g. longer than, shorter than)
- Students will classify solids and liquids into groups
- Students will categorize matter according to their properties and their behavior

LIFE SCIENCE: Structure and Function of Living Systems

SC.K.3: Students will classify the characteristics of living things.

State Standards (2.3.1, 2.1.1, 2.3.2)

- Students will differentiate between living and nonliving things
- Students will identify the external parts of an animal (e.g. parts of a snail, worm, and goldfish)
- Students will describe how offspring resemble their parents
- Students will relate through scientific communication (e.g. drawings) and data collection.

EARTH AND SPACE: Earth in Space

SC.K.4 Students will discriminate between objects in the sky.

State Standards (2.4.1, 2.1.1)

- Students will identify objects in the sky when they are observable (e.g. sun, moon, and stars)
- Students will identify objects that move in the sky (e.g. sun, moon, and stars)
- Students will construct an illustration of observable objects in the sky

SC.K.5 Students will evaluate simple patterns of change on Earth.

State Standard (2.4.3)

- Students will observe and describe simple daily weather
- Students will compare and contrast simple seasonal weather patterns. and how they impact student choices (e.g. activities, clothing choices)

First Grade Science

Students will apply scientific inquiry to demonstrate the growth of plants, animals in their distinct habitats, and exploration of Earth materials.

INQUIRY AND NATURE OF SCIENCE:

SC.01.1 Students will ask questions and conduct investigations that lead to observations and communications of findings.

State Standard (2.1.1)

- Students will ask questions that relate to a science topic.
- Students will conduct simple investigations.
- Students will select and safely use simple tools appropriately.
- Students will describe objects, organisms, or events using words or numbers.
- Students will collect and record observations.
- Students will use drawings and words to describe and share their observations with others.

LIFE SCIENCE: Plants

SC.01.2 Students will investigate the characteristics of living things. Students will distinguish characteristics of plants and their habitats.

State Standard (2.3.1)

- Students will state the basic needs of plants.
- Students will identify the parts of a plant.
- Students will classify plants in their distinct habitats.
- Students will observe, measure, and record the growth of plants.

LIFE SCIENCE: Animals

SC.01.3 Students will investigate the characteristics of living things and recognize changes in living things. Students will examine characteristics of animals, their offspring, and habitats.

State Standards (2.3.1, 2.3.2)

- Students will distinguish the differences of the physical characteristics of animals.
- Students will compare/contrast animals based on their needs and/or physical characteristics.
- Students will categorize animals based on their habitats.

EARTH STRUCTURES: Earth Materials

SC.01.4 Students will observe, identify and describe characteristics of the Earth's materials.

State Standard (2.4.2)

- Students will observe and identify physical properties of Earth materials. (rocks, soil, sand)
- Students will sort Earth materials by physical properties.
- Students will compare and contrast characteristics of Earth materials.
- Students will identify ways Earth materials can be used in our everyday lives.

Second Grade Science

Students will apply scientific inquiry to demonstrate how living things change and grow; weather's effects on earth; changes in position and movement; and properties of matter.

INQUIRY AND NATURE OF SCIENCE

SC.02.1 Students will ask questions and conduct investigations that lead to observations and communications of findings.

State Standard (2.1.1)

- Students will ask questions that relate to a science topic.
- Students will conduct simple investigations.
- Students will select and safely use simple tools appropriately.
- Students will describe objects, organisms, or events using words or numbers.
- Students will collect and record observations.
- Students will use drawings and words to describe and share their observations with others.

PHYSICAL SCIENCE - Force and Motion

SC.02.2 Students will compare relative position and motion of objects. Student will demonstrate position and motion relative to another object or its surroundings.

State Standard (2.2.1)

- Students will demonstrate positional terms relative to another object. (in front of, behind, over, under).
- Students will describe motions of common objects in terms of change in position or direction (up-down, left-right, fast-slow, etc.).
- Students will demonstrate motion relative to its surroundings by observing the change in position over time. (forward, backward, faster, slower, etc.).
- Students will demonstrate the way to change how something is moving is to give it a pull or push. The size of the change is related to the strength, or the amount of force of the pull or push.
- Students will show that an object continues to move in a straight line until change occurs. (force, weight, height).
- Students will describe the relationship between force and motion (how an object moves relative to the amount of force).

MATTER

SC.02.3 Students will observe and describe properties of objects and their behavior. Students will explore the states of matter: liquids and solids in order to compare and contrast properties of liquids and solids through investigation.

State Standard (2.2.3)

- Students will identify properties of solids (own shape, color, size, texture, rigid, flexible, hardness, etc.).
- Students will identify properties of liquids (shape of container, flowing, viscous, bubbly, transparent, opaque, translucent, colored).
- Students will compare and contrast properties by of liquids and solids.

- Students will measure the length of solid objects using rulers (centimeters) and meter sticks (meters).
- Students will measure the volume of liquids using common measuring tools (measuring cups, measuring spoons, cylinders and beakers).

LIFE SCIENCE - Heredity

SC.02.4 Students will recognize changes in living things. Students will verify that living things grow and change through the investigation of live insects.

State Standard (2.3.2)

- Students will identify the characteristics of insects (physical and habitat).
- Students will identify the sequence of an insect life cycle (mealworm, butterfly).
- Students will understand the life cycle and how new organisms are created by ones that die (beetles, caterpillars).
- Students will create and maintain individual live mealworm habitats.
- Students will plan and construct simple investigations to explore insects and their habitats.
- Students will identify that Entomologist's are scientists who study insects.

ENERGY IN EARTH'S SYSTEM

SC.02.5 Students will observe simple patterns of change on earth. Students will categorize the types of weather and temperatures into the four seasons in Nebraska.

State Standard (2.4.3)

- Students will investigate that the sun provides heat and light.
- Students will use simple weather instruments to measure and record weather data such as high and low temperatures, wind, precipitation, clouds (thermometer, rain gauge, wind sock, anemometer).
- Students will observe how weather affects the environment (agriculture, weather safety, seasonal activities).
- Students will understand that weather changes daily.
- Students will observe and illustrate how weather affects the four seasons in Nebraska.
- Students will describe the water cycle (evaporation, condensation).
- Students will identify that Scientists who study the weather are Meteorologists.

Third Grade Science

Students will apply science inquiry by observing characteristics of plants and animals and their life cycles, demonstrating how sound and light travels, and describing how objects in the sky move in patterns.

SCIENTIFIC INQUIRY

SC.03.1 Students will plan and produce investigations that lead to the development of explanations.
State Standards (5.1.1a, 5.1.1b, 5.1.1c, 5.1.1d, 5.1.1e, 5.1.1f, 5.1.1g, 5.1.1h)

- Students will state testable scientific questions (Question).
- Students will plan and produce investigations/identify factors that have the potential to impact an investigation (Purpose/Hypothesis/Variables).
- Students will choose and safely use appropriate equipment correctly and accurately (Materials).
- Students will identify and make relevant observations and measurements (Procedure).
- Students will compile/collect and organize data (Results).
- Students will formulate a reasonable explanation based on collected data (Conclusion).
- Students will state information, procedures, and results with peers and/or adults (Publish).
- Students will justify feedback on scientific investigations.

NATURE OF SCIENCE

SC.03.2 Students will analyze and describe how scientists go about their work.
State Standards (5.1.2 a, 5.1.2b, 5.1.2c)

- Students will identify scientific explanations based on evidence and scientific knowledge.
- Students will explain that new discoveries are always being made which impact scientific knowledge.
- Students will compare/contrast scientists to deduce that many different people study science.

SC.03.3 Students will plan and produce investigations that lead to the development of explanations.
State Standards (5.1.1a, 5.1.1b, 5.1.1c, 5.1.1d, 5.1.1e, 5.1.1f, 5.1.1g, 5.1.1h)

- Students will state testable scientific questions (Question).
- Students will plan and produce investigations/identify factors that have the potential to impact an investigation (Purpose/Hypothesis/Variables).
- Students will choose and safely use appropriate equipment correctly and accurately (Materials).
- Students will identify and make relevant observations and measurements (Procedure).
- Students will compile/collect and organize data (Results).
- Students will formulate a reasonable explanation based on collected data (Conclusion).
- Students will state information, procedures, and results with peers and/or adults (Publish).
- Students will justify feedback on scientific investigations.

PHYSICAL SCIENCE - Energy

SC.03.4 Students will examine characteristics of sound and light and how they travel. Observe and identify signs of energy transfer.
State Standards (5.2.2.a, 5.2.2b, 5.2.2c)

- Students will recognize that sound is produced from vibrating objects.
- Students will create vibrations using different objects to explain how sound is produced and how it effects the pitch and volume.
- Students will identify the path of light.
- Students will demonstrate that light travels in a straight line.
- Students will recognize that light can travel through certain materials and not others.
- Students will demonstrate how light travels through materials and not others. (transparent, translucent, and opaque)

EARTH AND SPACE - Space

SC.03.5 Students will observe and describe characteristics, patterns, and changes in the sky.
State Standard (5.4.1)

SC.03.6 Students will arrange models, organize and compare contrast characteristics, patterns, and changes in the sky.
State Standards (5.4.1a, 5.4.1b)

- Students will arrange models and label the basic moon phases.
- Students will compare and contrast planet characteristics.
- Students will arrange models and label the sun, moon, and earth.
- Students will define orbit, revolve, and rotate.
- Students will demonstrate how the moon, earth, and planets move in the solar system in relation to the sun.
- Students will identify planets in the solar system.
- Students will name the Big Dipper, Little Dipper, Sun, and Orion.
- Students will explain that constellations are patterns of stars seen in the sky.
- Students will explain that Earth's movements determine which constellations are visible from Earth.

LIFE SCIENCE

SC.03.7 Students will compare and contrast the characteristics of living things.
State Standards (5.3.1a, 5.3.1b)

- Students will identify the characteristics of living things.
- Students will identify the characteristics of nonliving things.
- Students will classify living and nonliving things.
- Students will define basic needs.
- Students will list the basic needs of a living organism.
- Students will identify plant parts and how the part functions to meet the plant's basic needs.
- Students will identify animal structures and how they function to meet the basic needs.

SC.03.8 Students will arrange and/or construct models, classify, and compare/contrast variations of inherited characteristics and life cycles.
State Standard (5.3.2)

- Students will define inherit, characteristics, variation.
- Students will classify plants and animals according to characteristics.
- Students will compare and contrast plant and animal groups and how each may have variations.
- Students will define life cycle.
- Students will arrange and/or construct models of plant life cycles.
- Students will arrange and/or construct models of an embryo.
- Students will compare and contrast plant and animal life cycles.

EMBRYOLOGY

SC.03.10 Students will analyze information, arrange and/or construct models, and compare and contrast the development of an embryo through its life cycle.

State Standards (5.3.1, 5.3.2)

- Students will identify the parts of an egg and its function.
- Students will construct a calendar to identify the development of an embryo and to plan for proper egg development.
- Students will identify basic needs of the embryo inside and outside the egg.
- Students will construct and/or arrange a model of an embryo's development and life cycle.
- Students will identify temperature in Fahrenheit.
- Students will identify characteristics of a chick and identify variations of chick breeds.

Fourth Grade Science

Students will be able to design and justify scientific inquiries, distinguish the relationship between force and motion, identify electrical and magnetic components, identify signs of energy transfer, investigate and compare characteristics of living things, describe changes in organisms over time, and describe relationships within ecosystems.

SCIENTIFIC INQUIRY

SC.04.1 Students will plan and produce investigations that lead to the development of explanations.
State Standards (5.1.1 a, b, c, d, e, f, g, h)

- Students will state testable scientific questions (Question).
- Students will plan and produce investigations/identify factors that have the potential to impact an investigation (Purpose/Hypothesis/Variables).
- Students will choose and safely use appropriate equipment correctly and accurately (Materials).
- Students will identify and make relevant observations and measurements (Procedure).
- Students will compile/collect and organize data (Results).
- Students will formulate a reasonable explanation based on collected data (Conclusion).
- Students will state information, procedures, and results with peers and/or adults (Publish).
- Students will justify feedback on scientific investigations.

NATURE OF SCIENCE

SC.04.2 Students will analyze and describe how scientists go about their work.
State Standards (5.1.2 a, b, c)

- Students will identify scientific explanations based on evidence and scientific knowledge.
- Students will explain that new discoveries are always being made which impact scientific knowledge.
- Students will compare/contrast scientists to deduce that many different people study science.

ELECTRICITY & MAGNETISM

SC.04.3 Students will use insulators/conductors to compare/contrast the energy transfer through the creation of a variety of electrical circuits. (simple, series, parallel circuits) Students will identify sources of mechanical and electrical heat. Students will identify and diagram magnetic properties and behaviors. Students will design an electromagnet.
State Standards (5.2.1 c - 5.2.2 d, e, f – 5.1.1)

- Students will identify signs of energy transfer (heat-feel, light-see).
- Students will identify insulators/conductors (energy transfer & electrical).
- Students will identify the components and construct simple, series, parallel circuits.
- Students will demonstrate how electrical circuits are used in everyday life.
- Students will identify magnet/magnetic properties (particles, poles, magnetic field).
- Students will diagram and justify magnetic behavior (attraction/repulsion).
- Students will identify components and design an electromagnet.

LIFE SCIENCE

SC.04.4 Students will compare/contrast physical characteristics, habitat and adaptations of vertebrate/invertebrate animals in relationship in their ecosystem over time. Design and justify a fictional animal in its appropriate ecosystem.

State Standards (5.3.1 a, b, - 5.3.3 a – 5.3.4 a – 5.1.1)

- Students will identify and compare/contrast the components of an ecosystem (terrestrial/aquatic –e.g. forest, arctic, grass land, desert, tundra, urban/lake, river, swamp, ocean).
- Students will identify and justify the necessity of specific physical characteristics of animals (e.g. size, weight, surface covering, color).
- Students will compare/contrast habitat of animals (e.g. where live, shelter, food, predator, prey, family, born/hatched).
- Students will identify adaptations that aid in an animal’s survival (e.g. seasonal changes, special body parts, special behaviors).
- Students will diagram a food chain.
- Students will design and justify a fictional animal in its appropriate ecosystem.

EARTH AND SPACE SCIENCE: Earth Structures

SC.04.5 Students will examine (our planet’s composition) by researching the development and sustainability of Earth’s materials, structure, and processes that build up and break down the Earth’s surface.

State Standard (5.4.2)

- Students will define mineral.
- Students will name and describe the formation of minerals.
- Students will identify properties of minerals.
 - Luster, streak, color, hardness, cleavage.
- Students will define rock.
- Students will identify characteristics of rocks.
 - Color, size, weight, composition, layers, and sheen.
- Students will identify and explain the formation of the rock groups.
 - Sedimentary, igneous, metamorphic.
- Students will explain the rock cycle.
- Students will determine uses of rocks (jewelry, buildings, decorations, machines, tools, roads, bridges, consumables).
- Students will define soil.
- Students will identify the 5 main parts of soil.
 - Humus, clay, silt, sand, gravel.
- Students will identify the 4 layers of soil.
 - Topsoil, subsoil, substrata, bedrock (color, content, & depth).
- Students will describe the importance of soil.
- Students will define erosion and weathering and explain their impacts on the environment.
- Students will discuss other hazardous effects on Earth’s surface (i.e. pollution (above ground), contamination (underground), overuse).
- Students will research an environmental issue and share information.

Fifth Grade Science

Students will conduct and analyze investigations to identify and describe the nature of matter, the relationships between force and motion, and the effects of energy changes on Earth.

SCIENTIFIC INQUIRY

SC.05.1 Students will plan and produce investigations that lead to the development of explanations.
State Standard (5.1.1)

- Students will state scientific questions that can be tested (Question).
- Students will plan and produce investigations and identify variables (Hypothesis).
- Students will choose and safely use appropriate equipment correctly and accurately (Materials).
- Students will identify and make relevant observations and measurements (Procedure).
- Students will compile and organize data (Results).
- Students will formulate a reasonable explanation based on collected data (Conclusion).
- Students will state information, procedures, and results with peers and/or adult (Publish).
- Students will justify feedback on scientific investigations.

NATURE OF SCIENCE

SC.05.2 Students will analyze and describe how scientists go about their work.
State Standard (5.1.2)

- Students will identify scientific explanations based on evidence and scientific knowledge.
- Students will explain that new discoveries are always being made which impact scientific knowledge.
- Students will compare/contrast scientists to deduce that many different people study science.

PHYSICAL SCIENCE: Matter

SC.05.3 Students will communicate the properties of matter and their changes by carrying out an experiment where a measurable change of state takes place.
State Standard (5.2.3)

- Students will define matter.
- Students will define property.
- Students will define solid, liquid, gas and the changes that occur between the states of matter.
- Students will evaluate and classify materials as a solid, liquid, or gas.
- Students will create a representation of the states of matter (visual, oral, auditory, kinesthetic, multimedia).
- Students will compare/contrast states of matter.
- Students will identify physical properties of matter.
 - Color, odor, luster, hardness, melting/freezing/boiling point, mass, weight, volume, length.
- Students will use appropriate metric measurements to describe physical properties.
 - Metric temperature, length, mass, volume.

PHYSICAL SCIENCE - Force and Motion

SC.05.4 Students will compare/contrast the effects of different types of forces on motion by developing and conducting an investigation that demonstrates the relationship between force and motion.

State Standards (5.2.1 a, b, – 5.1.1)

- Students will identify forces (Newton’s 2nd Law, push, pull, gravity, friction).
- Students will identify motion (changing position = direction or speed, speed = distance divided by time).
- Students will demonstrate and record the changing position of an object over time (speed) to show motion.
- Students will identify and record how changes in motion of an object are caused by forces.
- Students will compare/contrast the effects of different types of forces on motion.
- Students will develop and conduct an investigation that demonstrates the relationship between force and motion.

EARTH AND SPACE SCIENCE: Weather

SC.05.5 Students will analyze weather, atmosphere, air pressure, wind, and clouds to determine the effects of energy changes on Earth.

State Standard (5.4.3)

- Students will define weather and where it occurs.
 - Explain how the greenhouse effect warms Earth and relates to temperature.
 - Examine a thermometer to monitor daily temperature, a barometer to determine air pressure, and an anemometer to determine wind speed.
- Students will differentiate between weather and climate.
- Students will research the influence of the sun’s energy on water, land, and air.

Sixth Grade Science

Students will integrate and communicate the information, concepts, principles, processes, theories, and models of the Physical Sciences to make real life connections with the natural and engineered world.

SC.06.1 Students will demonstrate their knowledge of the Scientific Method and be able to identify and apply the three variables in an experiment.

State Standards (8.1.1 a-g)

- Students will list the order of the Scientific Method.
- Students will determine the three variables in a variety of experiments (manipulated, responding, and controlled).
- Students will formulate testable questions that lead to predictions and scientific investigations.
- Students will design and conduct logical and sequential investigations including repeated trials.
- Students will make quantitative and qualitative observations.
- Students will record and represent data appropriately and evaluate for quality, accuracy, and relevancy .
- Students will evaluate predictions, draw logical inferences based on observed patterns/relationships, and account for non-relevant information.
- Students will develop a reasonable explanation based on collected data.
- Students will select and safely use equipment appropriate to the investigation and demonstrate correct techniques.

SC.06.2 Students will apply the nature of science to their own investigations.

State Standards (8.1.1 a-g, 8.1.2 a, b; 8.2.3 c)

- Students will identify the four states of matter (solid, liquid, gas, plasma).
- Students will differentiate the arrangement of atoms within the four states of matter.
- Students will investigate properties of air and water.
- Students will evaluate current understandings in science and how that changes as new data is discovered.
- Students will describe how scientific discoveries influence and change society.

SC.06.3 Students will investigate and describe forces and motion

State Standards (8.2.1 a-c, 8.1.2 a)

- Students will identify and investigate the three Laws of Motion.
- Students will describe how the position, speed, and/or direction of an object changes when an unbalanced force is applied to that object.
- Students will investigate factors that influence a pendulum.
- Students will describe the motion of objects related to the effects of balanced and unbalanced forces (Newton's 2nd Law).
- Students will recognize that everything on or around the Earth is pulled toward the Earth's center by gravitational force.
- Students will examine how friction influences motion.

SC.06.4 Students will identify and describe how energy systems and matter interact.

State Standards (8.2.2 c, d; 8.2.3 c)

- Students will demonstrate that light interacts with matter (including reflection, refraction, and absorption) in different ways.
- Students will calculate the Laws of Reflection and Refraction.
- Students will measure the heat absorption of different colored materials.
- Students will recognize that heat moves from warmer objects to cooler objects until both reach the same temperature.
- Students will investigate and describe the relationship between the temperature and the movement of the molecules.

Seventh Grade Science

Students will integrate and communicate the information, concepts principles, processes, theories and models of the life sciences to make connections with the natural and engineered world. Students will understand what life is, how life works, and how science helps us to take care of our own personal health.

Science is a way of knowing, a process for gaining knowledge and understanding of the natural world. The Science Core Curriculum places emphasis on understanding and using skills. Students should be active learners. It is not enough for students to read about science; they must do science. They should observe, inquire, question, formulate and test hypotheses, analyze data, report, and evaluate findings. The students, as scientists, should have hands-on, active experiences throughout the instruction of the science curriculum.

7th Grade High Achievement Unit Outcomes

SC.07.1 Students will analyze identify characteristics of organisms that help them survive.

- Students will give examples to illustrate an inherited characteristic that would enable an organism to better survive and reproduce.
- Students will relate the extinction of a species to an inability to adapt to an environmental change.
- Students will explain how internal systems might adapt in response to changes in the organism's environment (homeostasis).

Structure and Function of Living Systems

SC.07.2 Students will investigate and describe the structure (form) and function of living organisms. Students will be able to identify at least one part of each system within in the human body. Students will then analyze structure within the system and factors that enable it to do its function.

State Standards (8.3.1)

- Students will recognize that all organisms are composed of cells.
- Students will investigate the levels of organization (cells, tissues, organs, organ system, and organisms).
- Students will relate the structure of a specialized cell to the function the structure of a specialized cell to the function that cell performs in plants and animals (e.g. muscular cells, skeletal cells).
- Students will identify the functions of the major systems of the human body and describe ways that these systems interact with each other.
- Students will give examples of how plants and animals respond to their needs and environmental stimuli.

Inquiry and Nature of Science

SC.07.3 Students will design and conduct investigations that will lead to descriptions of relationships between evidence and explanations. Students will apply their understanding of scientific problem solving by designing and conducting their own scientific investigation.

State Standards (8.3.3)

- Students will formulate testable questions that lead to predictions and scientific investigation.
- Students will design and conduct logical and sequential investigations including repeated trials.

- Students will determine controls and use dependent (responding) and independent (manipulated) variable.
- Students will select and safely use equipment appropriate to the investigation and demonstrate correct techniques.
- Students will make a qualitative and quantitative observations.
- Students will record and represent data appropriately and evaluate for quality accuracy and relevancy.
- Students will evaluate predictions, draw logical inferences based on observed patterns/relationships, and account for non-relevant information.
- Students will share information procedures, results and conclusions will appropriate audiences.
- Students will analyze and provide appropriate critique of scientific investigations.

Flow of Matter and Energy in Ecosystems

SC.07.4 Students will analyze major biomes of the world to determine characteristics, populations and ecosystems. They will determine factors that affect biome success. Students will use their information to create a food web including producer, primary and secondary consumers, and decomposers on a given biome as well as basic characteristics of the biome.
State Standards (8.3.3)

- Students will identify characteristics (soil, plants, animals, and climate) of each biome (Tundra, Taiga, Temperate forest, Grassland, Desert, Tropical Rainforest, Aquatic).
- Students will illustrate a food chain or web within a particular biome. (8.3.3 a)
- Students will describe an energy pyramid within a biome including producer, primary and secondary consumers, and decomposers. (Plants, herbivores, carnivores, omnivores, and bacteria and fungi). (8.3.3b)
- Students will define a population as all the individuals of a species at a given place and time. (8.3.3 c)
- Students will relate diversity to total population within a biome.
- Students will analyze the biotic and abiotic factors that determine the number of organisms an ecosystem can support. (8.3.3d)
- Students will identify positive and negative effects of natural and human activity on an ecosystem. (8.3.3e)

Heredity

Students will investigate and describe the relationship between reproduction and heredity. Students will evaluate a family tree by applying a Punnett Square to determine how genetic traits are passed from generation to generation.

State Standards (8.3.2)

- Students will explain that cellular information is contained in genes in the chromosomes of each cell.
- Students will compare and contrast sexual and asexual reproduction .
- Students will describe how cells reproduce (mitosis).
- Students will describe how sex cells reproduce (meiosis).
- Students will investigate and describe the effects of inherited traits and environmental factor that influence heredity.

Nature of Science

Students will apply the nature of science to their own investigations. Students will construct a project that that describes the dynamic nature of science and highlights major contributions throughout history.

State Standards (8.3.3)

- Students will recognize science is an ongoing process and the scientific community accepts and uses explanations until they encounter new experimental evidence not matching existing explanations.
- Students will describe how scientific discoveries influence and change society.
- Students will recognize scientist from various cultures have made many contributions to explain the natural world.

Eight Grade Science

Students will design and conduct investigations that will apply the nature of science. They will identify and describe the nature of matter, the Earth and the Solar System, and energy in Earth's systems.

8th Grade High Achievement Unit Outcomes

SC.08.1 Students will develop an understanding of the nature of science through describing, designing, conducting, and evaluating an experimental investigation through the use of the scientific method.

State Standards (8.1.1a)

- Students will define Observation and inference.
- Students will classify a statement as either an observation or an inference.
- Students will construct an inference given an observation.
- Students will make qualitative and quantitative observations.
- Students will demonstrate the correct and appropriate use of metric measurement.
- Students will evaluate a situation and develop an observation and inference statement.
- Students will define hypothesis.
- Students will list the steps of the scientific method in order.
- Students will identify and describe the different variables (manipulated/independent, responding/dependent, and controlled).
- Students will construct, organize, and analyze data and graphs.
- Students will formulate and share conclusions based on patterns and relationships within an experiment.
- Students will analyze experiments to determine validity.
- Students will design and conduct logical and sequential investigations including repeated trials.

SC.08.2 Students will identify and describe the nature of matter by comparing and contrasting physical and chemical properties, physical and chemical changes, and the properties of matter through the organization of the periodic table.

State Standards (8.2.3a-f)

- Students will identify the states of matter.
- Students will compare and contrast the characteristics between solids, liquids, and gases (mass, volume, shape, molecular arrangement, molecular motion).
- Students will identify the differences between physical and chemical properties.
- Students will identify and describe the physical properties of matter such as mass, volume, and density.
- Students will compute density of matter using the density formula.
- Students will define elements, compounds and mixtures.
- Students will compare and contrast the characteristics of elements, compounds and mixtures.
- Students will identify and label a model of atomic structure.
- Students will identify the difference between a physical and chemical changes.
- Students will demonstrate physical and chemical changes.
- Students will distinguish between physical and chemical changes.
- Students will select reactants and products in a chemical reaction.

- Students will tell the indications of a chemical reaction.
- Students will demonstrate balanced equations.
- Students will identify evidence supporting the law of conservation of matter.
- Students will examine the properties of matter through the organization of the periodic table.

SC.08.3 Students will investigate and describe the earth’s structure, processes, and systems to analyze earth’s natural resources.

State Standards (8.4.2a-e)

- Students will identify the 3 rock families.
- Students will compare and contrast the characteristics of the 3 rock families.
- Students will examine the everyday uses of rocks.
- Students will diagram the rock cycle.
- Students will identify and describe the layers of the earth.
- Students will identify and define weathering and erosion.
- Students will list the agents of weathering and erosion.
- Students will analyze the destructive forces of the earth caused by earth’s crustal movements.
- Students will compare and contrast the constructive and destructive forces that change earth’s surface.
- Students will classify Earth materials as renewable or nonrenewable.

SC.08.4 Students will investigate and describe the Earth and the solar system through the examination of the universal force of gravity.

State Standards (8.4.1a-c)

- Students will identify and describe the components of the solar system (sun, moon, planets, comets, asteroids).
- Students will differentiate between rotation and revolution.
- Students will demonstrate what causes seasons.
- Students will describe the phases of the moon and how the motions of the earth and moon cause phases.
- Students will diagram the phases of the moon.
- Students will model how both solar and lunar eclipses occur.
- Students will describe the structure of the sun.
- Students will evaluate features of the sun, such as sunspots and solar flares, are related.
- Students will classify our sun and other stars based on characteristics.
- Students will diagram the life cycle of a star such as our sun.
- Students will explain the effects of gravity within the earth-moon system, the planets, and our sun

SC.08.5 Students will examine and describe the earth’s atmosphere and the phenomena of weather through investigating the effects of the sun’s energy.

State Standards (8.4.3)

- Students will identify the gases in the earth’s atmosphere.
- Students will describe the structure of the earth’s atmosphere.
- Students will examine what factors effect air pressure.
- Students will describe how energy from the Sun influences the atmosphere and the Earth’s surface.
- Students will compare and contrast radiation, convection, and conduction.
- Students will explain the water cycle.
- Students will diagram the water cycle.

- Students will define weather.
- Students will evaluate the relationship between air pressure, temperature and humidity.
- Students will explain cloud formation.
- Students will compare and contrast the types of precipitation.
- Students will describe how weather is associated with fronts and high and low pressure areas.
- Students will explain how severe weather forms.
- Students will analyze why global air patterns are determined by latitude and Earth's uneven heating.

Ninth Grade

The students will apply the scientific method by designing an experiment using the introductory physics concepts. The students will also interpret earth science concepts and apply them to real life situations.

FORCE AND MOTION

SC.09.1 Students will analyze motion, Newton's laws of motion and universal forces. They will apply the concepts of forces and motion to real-world situations.

State Standards (12.2.1a, 12.2.1b, 12.2.1c, 12.2.1d, 12.2.1e, 12.2.1f, 12.2.1g, 12.2.1h)

- Students will relate motion to displacement, velocity, and acceleration.
- Students will identify that an object moving will stay in motion unless acted upon by an outside force (Newton's 1st law).
- Students will apply the law of inertia (Newton's 1st law) to real-world situations.
- Students will evaluate the relationships between net forces, mass and acceleration (Newton's 2nd law).
- Students will identify that every force will have an equal and opposite force (Newton's 3rd law).
- Students will apply Newton's 3rd law to real-world situations.
- Students will identify that gravitational force is an attraction between masses and the strength of the force is related to mass and distance between the objects.
- Students will identify that electrical forces attract or repel between any two charged particles and the strength of the electrical force is related to the magnitude of charge and distance between charges.
- Students will design a lab applying forces and motion in real-world situations.

ENERGY

SC.09.2 Students will analyze sound/mechanical waves, light as waves, heat transfer, electromagnetic waves/spectrum, conservation of energy, energy transfer and mechanical energy. They will apply waves and energy to real-life situations.

State Standards (12.2.2a, 12.2.2b, 12.2.2c, 12.2.2d, 12.2.2e, 12.2.2f, 12.2.2g, 12.2.2i, 12.2.2j, 12.2.2k, 12.2.3b)

- Students will identify fundamental properties of waves (speed, wavelength, frequency, and amplitude) and how waves travel through different substances.
- Students will recognize the energy in waves can change into other forms of energy.
- Students will explain how light can behave as a wave (diffraction and interference).
- Students will distinguish between temperature and heat (average kinetic energy of atomic or molecular and quantity of thermal energy in changing temperatures).
- Students will analyze interactions of heat and transference of heat through different mediums though conduction, convection and radiation.
- Students will determine how the electromagnetic waves are produced by changes in the charges motion or magnetic field.
- Students will distinguish between the segments of the electromagnetic spectrum using frequency and wavelength.
- Students will define the ways energy can be transferred from one type to another.
- Students will justify that energy is conserved and draw conclusions for an outcome of certain situations.
- Students will design a lab applying energy in real-world situations.
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SCIENTIFIC INQUIRY AND NATURE OF SCIENCE

SC.09.3 Students will develop investigations that will allow the students to draw conclusions to scientific models and explanations. They will apply the inquiry and nature of science throughout the course.

State Standards (12.1.1a, 12.1.1b, 12.1.1c, 12.1.1d, 12.1.1e, 12.1.1f, 12.1.1g, 12.1.1h, 12.1.1i, 12.1.1j, 12.1.1k, 12.1.2a, 12.1.2b, 12.1.2c, 12.1.2d)

- Students will create a hypothesis using previous knowledge to direct experiments.
- Students will conduct investigations with repeating trials will allow them to apply the new findings.
- Students will identify the variables and parameters of experiments.
- Students will choose laboratory equipment, technology, and math concepts accurately.
- Students will demonstrate how technology will be used to make qualitative and quantitative inquiries.
- Students will assess the data gained from investigations.
- Students will analyze data, models, concepts and explanations in science.
- Students will identify conclusions that verify or refute hypotheses.
- Students will state changes and/or different explanations to make the hypothesis accurate.
- Students will teach others in the scientific community about the procedures, results, conclusions, etc.
- Students will evaluate investigations and lend revisions/new ideas when appropriate.
- Students will identify that scientific explanations can be questioned, changed and based on prior and/or present knowledge.
- Students will describe how humans alter scientists' findings and how scientific findings affect society.
- Students will identify that science builds on prior knowledge.
- Students will explain the problems that early scientists had to overcome and what ground work was laid for what we know now.
- Students will design, test, alter and retry an investigation experiencing some of the problems earlier scientists dealt with in an effort to see how scientific theories have developed.

EARTH AND SPACE SCIENCE

SC.09.4 Students will analyze the known universe, Earth's structure, Earth's systems, Earth's processes, sources/effects of energy on the Earth and explain the history of the evolution of the Earth.

State Standards (12.2.2h, 12.4.1a, 12.4.1b, 12.4.2b, 12.4.2c, 12.4.3a, 12.4.3b, 12.4.3c, 12.4.3d, 12.4.4a, 12.4.4b)

- Students will identify that nuclear reactions transform a part of the mass of interacting particles into energy and the energy produced is larger than chemical reactions.
- Students will compare and contrast the theories behind how planets, stars, galaxies, and the universe formed.
- Students will identify that stars (our Sun) use nuclear reactions to change matter into energy.
- Students will explain the theory of plate tectonics.
- Students will analyze the effects of humans have had on the Earth's resources (groundwater, rivers, land, fossil fuels, etc.).
- Students will state the internal and external sources of energy in the Earth's systems.
- Students will compare and contrast the radiation, conduction and convection as mechanisms of heat transfer in the Earth's systems.
- Students will explain the differences in the renewable and nonrenewable energy sources.

- Students will describe what influences global climate (Earth's rotation, mountain ranges, oceans, differential heating, etc.)
- Students will list the methods of estimating geologic time (fossils in the rock sequences, radioactive isotopes, etc.)
- Students will relate the Earth's early years to the present.
- Students will identify known parts of the universe related to the Earth and all of its evolution in our lives.

Biology

Students will demonstrate, discriminate, assess and evaluate living organisms and their functions. Subjects included are inquiry, cells and cell function, heredity, energy flow and ecosystems, and biodiversity, adaptations and evolution.

HEREDITY

SC.BIO.1 Students will analyze the molecular basis of reproduction, heredity and mutations by decoding information present in DNA and using the information to predict offspring possibilities.

State Standards (12.3.2)

- Students will label the various parts of a DNA molecule. 12.3.2b
- Students will reproduce a DNA molecule by selecting the appropriate nitrogenous bases and putting them in the correct order. 12.3.2b
- Students will draw and label the cell stages of meiosis. 12.3.2c
- Students will summarize the findings of Gregor Mendel. 12.3.1a
- Students will explain chromosomes and how they relate to inheritance. 12.3.2a, c
- Students will diagram mono and dihybrid crosses using Punnett squares. 12.3.2c
- Students will explain words how hybridization effects heredity. 12.3.2c
- Students will analyze the results of incomplete codominance utilizing Punnett squares. 12.3.2a
- Students will assess the results of sex-linked traits in terms of phenotype and genotype. 12.3.2a, c
- Students will apply the ideas of Gregor Mendel and Punnett squares to human genetics. 12.3.2c
- Students will outline the results of alterations of chromosome number and structure as they apply to human genetics. 12.3.2c
- Students will explain mutations and outline their effects on cells. 12.3.2b, 12.3.4b

BIODIVERSITY

SC.BIO.2 Students will evaluate the theory of biological evolution by comparing and contrasting morphological, physiological, and behavioral adaptations necessary for survival. They will use the theory of natural selection to assess the changing diversity of life, with emphasis being placed on micro evolution and its effects on populations.

State Standards (12.3.4)

- Students will list the reasons why Charles Darwin is considered to be the father of evolution. 12.3.4b
- Students will explain the theory of natural selection. 12.3.4b, 12.3.4d
- Students will compare and contrast micro/macro evolution. 12.3.4b, 12.4.4a
- Students will relate the importance of diversity to the process of natural selection. 12.3.4c
- Students will examine the process of speciation to explain how natural selection can lead to change. 12.3.4b
- Students will construct a list of evidence used to support evolution. 12.3.4a, 12.4.4a

- Students will assess how micro evolution can be validated by the study of how populations adapt. 12.3.4b

STRUCTURE AND FUNCTION OF LIVING SYSTEMS

SC.BIO.3 Students will analyze and apply the chemical basis of the growth, to the development, and maintenance of cells. They will relate the form and function of organelles that regulate cellular activities as well as cellular functions to mitosis, photosynthesis, protein synthesis, and cellular respiration.

State Standards (12.3.1)

- Students will compare and contrast prokaryote and eukaryote. 12.3.1a
- Students will relate cell function to cell size. 12.3.1a
- Students will diagram cell membrane structure and assess how that relates to function. 12.3.1a
- Students will match cell organelles to their function. 12.3.1a
- Students will draw and label the cell stages of mitosis. 12.3.1b
- Students will describe homeostasis. 12.3.1c
- Students will outline energy usage in cells. 12.3.1b
- Students will compare kinetic and potential energy. 12.3.1b
- Students will discriminate between diffusion, osmosis, passive, and active transport. 12.3.1b
- Students will describe facilitated transport as it relates to cell membranes. 12.3.1b
- Students will distinguish between protein synthesis, cellular respiration, photosynthesis, fermentation, and metabolism by diagramming, modeling, categorizing or illustrating. 12.3.1b

FLOW OF MATTER AND ENERGY IN ECOSYSTEMS

SC.BIO.4 Students will describe, on a molecular level, the cycling of matter and the flow of energy between organisms and their environment. They will explain how factors affect biological diversity, in populations, communities, ecosystems, and biomes. They will analyze human impact and its effect on the stability of the environment.

State Standards (12.3.3)

- Students will evaluate the importance of energy dynamics on populations and population growth. 12.3.3c
- Students will compare and contrast populations, communities, ecosystems, biomes, and the biosphere. 12.3.3a, 12.3.3c
- Students will diagram what happens to energy as it moves through the ecosystem. 12.3.3a
- Students will discuss how ecological pyramids shape interactions that occur in ecosystems. 12.3.3a
- Students will distinguish between predation and competition as interactions that shape ecosystems. 12.3.3a
- Students will list examples of density dependent and independent limiting factors. 12.3.3a
- Students will compare and contrast abiotic and biotic factors. 12.3.3d
- Students will evaluate the effects biogeochemical cycles have on organisms within ecosystems. 12.3.3b, 12.4.2a

- Students will define limiting nutrients and describe how they affect population growth. 12.3.3b
- Students will describe the difference between the forms of organism interactions that occur in ecosystems. 12.3.3a
- Students will analyze human activities and their effects on environmental quality. 12.3.3d

INQUIRY AND NATURE OF SCIENCE 12.1.1

SC.BIO.5 Students will design and conduct investigations using tools and technology that lead to the use of logic and evidence in the formulation of scientific explanations and models. They will evaluate and represent data collected in a systematic, accurate and objective matter to verify and refute hypotheses and to formulate revisions and alternative explanations.

State Standards (12.1.1)

- Students will evaluate, select, and correctly use equipment to conduct scientific experiments. 12.1.1d, 12.1.1e
- Students will create and conduct a controlled scientific investigation that models a testable hypothesis, and provides for opportunities to analyze, evaluate, and accurately present quantitative and qualitative data. 12.1.1a, 12.1.1b, 12.1.1c, 12.1.1e, 12.1.1f, 12.1.1g, 12.1.1h, 12.1.1i, 12.1.1j,

Honors Biology

Honors Biology is an accelerated, challenging class for those students who qualify. Subjects included are inquiry, cells and cell function, heredity, energy flow and ecosystems, biodiversity (adaptations and evolution), atomic structure, properties and structure of matter, and biochemistry. Students will demonstrate an understanding of basic principles, apply basic principles to new situations, integrate those situations and evaluate the final results.

INQUIRY AND NATURE OF SCIENCE

SC.HB.1 Students will design and conduct investigations using tools and technology that lead to the use of logic and evidence in the formulation of scientific explanations and models. They will evaluate and represent data collected in a systematic, accurate and objective manner to verify and refute hypotheses and to formulate revisions and alternative explanations.

State Standards (12.1.1)

- Students will evaluate, select, and correctly use equipment to conduct scientific experiments. 12.1.1d, 12.1.1e
- Students will create and conduct a controlled scientific investigation that models a testable hypothesis, and provides for opportunities to analyze, evaluate, and accurately present quantitative and qualitative data. 12.1.1a, 12.1.1b, 12.1.1c, 12.1.1e, 12.1.1f, 12.1.1g, 12.1.1h, 12.1.1i, 12.1.1j,

BIOCHEM

SC.HB.2 Students will demonstrate their understanding of atomic structure as it applies to living systems. They will compare and contrast the varying molecular characteristics of water and its role in dehydration synthesis and hydrolysis reactions. They will be able to visually identify the functional groups that classify macromolecules. They will analyze the characteristics of macromolecules and discuss their roles in living systems.

State Standards (12.2.3)

- Students will demonstrate hyper/hypo/isotonic solutions by predicting and completing diagrams of what would happen to a cell placed in one of these solutions. 12.2.3b
- Students will define solute/solvent/solution and give an example of each. 12.2.3b
- Students will relate ionic/covalent/polar/nonpolar bonds. 12.2.3a
- Students will differentiate hydrogen bonds from ionic and covalent bonds. 12.2.3a
- Students will diagram how an isotope is similar and different from other atoms of the same element. 12.4.4a, 12.2.3e
- Students will analyze the characteristics and properties of carbon and compare and contrast that to other elements found in living organisms such as hydrogen, oxygen, and nitrogen. 12.2.3a
- Students will define polymer/monomer. 12.2.3a

- Students will distinguish between protons/neutrons/electrons of an atom and be able to calculate protons/neutrons/electrons of an element based on its position on the periodic table. 12.2.3d
- Students will compare and contrast elements/compounds/molecules. 12.2.3a
- Students will list the characteristics of water and model the polarity of water. 12.2.3a
- Students will demonstrate how water is important to living systems in terms of phase changes and solubility. 12.2.3.b
- Students will demonstrate the rule of eight electrons and electron shells in relationship to the periodic table. 12.2.3.f
- Students will identify reactants and products in chemical reactions. 12.2.3
- Students will relate carbon molecular skeletons and functional groups to the appropriate category of macromolecule. 12.2.3
- Students will differentiate between monomer and polymer as they relate to macromolecules. 12.2.3
- Students will diagram dehydration synthesis and hydrolysis reactions as they relate to monomers and polymers of macromolecules. 12.2.3
- Students will distinguish between monomers and polymers of carbohydrates, proteins and nucleic acids and defend why lipids are not considered polymers. 12.2.3
- Students will carbohydrates/monosaccharides/disaccharides/polysaccharides. 12.2
- Students will diagram the differences between starch, glycogen, and cellulose. 12.2
- Students will evaluate unsaturated, saturated, and trans fat and their effects on the human body. 12.2.3
- Students will categorize phospholipids, waxes, steroids/hormones. 12.2
- Students will evaluate diet in terms of the essential and nonessential amino acids. 12.2
- Students will differentiate the seven classes of proteins. 12.2
- Students will differentiate DNA from RNA. 12.2

STRUCTURE AND FUNCTION OF LIVING SYSTEMS 12.3.1

SC.HB.3 Students will analyze and apply the chemical basis of the growth, to the development, and maintenance of cells. They will relate the form and function of organelles that regulate cellular activities as well as cellular functions to mitosis, photosynthesis, protein synthesis, and cellular respiration.

State Standards (12.3.1)

- Students will compare and contrast prokaryote and eukaryote. 12.3.1a
- Students will relate cell function to cell size. 12.3.1a
- Students will diagram cell membrane structure and assess how that relates to function. 12.3.1a
- Students will match cell organelles to their function and location within a cell. 12.3.1a
- Students will draw and label the cell stages of mitosis. 12.3.1b
- Students will compare and contrast the differences in mitosis of plant and animal cells. 12.3.1
- Students will relate cancer to unregulated cell mitosis. 12.3.1
- Students will describe homeostasis. 12.3.1c
- Students will outline energy usage in cells. 12.3.1b
- Students will define the 1st & 2nd laws of thermodynamics. 12.3.1

- Students will compare kinetic and potential energy. 12.3.1b
- Students will analyze graphs related to endergonic and exergonic chemical reactions. 12.3.1
- Students will relate how enzymes/catalysts help to lower energy of activation. 12.3.1
- Students will discriminate between diffusion, osmosis, passive, and active transport. 12.3.1b
- Students will diagram the response of a cell placed in an isotonic, hypertonic, or hypotonic solution. 12.2.3
- Students will state the difference between exocytosis, endocytosis, and pinocytosis.
- Students will describe facilitated transport as it relates to cell membranes. 12.3.1b
- Students will distinguish between protein synthesis, cellular respiration, photosynthesis, fermentation, and metabolism by diagramming, modeling, categorizing or illustrating. 12.3.1b

HEREDITY

SC.HB.4 Students will analyze the molecular basis of reproduction, heredity and mutations by decoding information present in DNA and using the information to predict offspring possibilities.

State Standards (12.3.2)

- Students will label the various parts of a DNA molecule. 12.3.2b
- Students will reproduce a DNA molecule by selecting the appropriate nitrogenous bases and putting them in the correct order. 12.3.2b
- Students will draw and label the cell stages of meiosis. 12.3.2c
- Students will summarize the findings of Gregor Mendel and the gene idea. 12.3.1a
- Students will explain chromosomes and how they relate to inheritance. 12.3.2a, c
- Students will diagram mono and dihybrid crosses using Punnett squares. 12.3.2c
- Students will explain in their own words how hybridization effects heredity. 12.3.2c
- Students will analyze the results of incomplete and codominance utilizing Punnett squares. 12.3.2a
- Students will assess the results of sex-linked traits in terms of phenotype and genotype. 12.3.2a, c
- Students will apply the ideas of Gregor Mendel and Punnett squares to human genetics. 12.3.2c
- Students will outline the results of alterations of chromosome number and structure as they apply to human genetics. 12.3.2c
- Students will explain mutations and outline their effects on organisms. 12.3.2b, 12.3.4b
- Students will define and give an example of selective breeding. 12.3.2
- Students will compare and contrast inbreeding and outbreeding. 12.3.2
- Students will define genetic engineering. 12.3.2
- Students will define and give an example of a transgenic organism. 12.3.2
- Students will defend gene therapy in a short essay. 12.3.2
- Students will analyze the results of a gel electrophoresis to categorize an individual by their DNA fingerprint. 12.3.2
- Students will debate the pros and cons of cloning. 12.3.2

BIODIVERSITY

SC.HB.5 Students will evaluate the theory of biological evolution by comparing and contrasting morphological, physiological, and behavioral adaptations necessary for survival. They will use the theory of natural selection to assess the changing diversity of life, with emphasis being placed on micro evolution and its effects on populations.

State Standards (12.3.4)

- Students will list the reasons why Charles Darwin is considered to be the father of evolution. *12.3.4b*
- Students will explain in their own words the theory of natural selection. *12.3.4b, 12.3.4d*
- Students will compare and contrast micro/macro evolution. *12.3.4b, 12.4.4a*
- Students will relate the importance of diversity to process of natural selection. *12.3.4c*
- Students will examine the process of speciation to explain how natural selection can lead to evolution. *12.3.4b*
- Students will construct a list of evidence used to support evolution. *12.3.4a, 12.4.4a*
- Students will assess how micro evolution can be validated by the study of how populations adapt. *12.3.4b*

TAXONOMY AND ANIMALS

SC.HB.6 Students will apply information from previous units on cells, heredity, and evolution by reporting on a category of animals and how they fit within the animal kingdom.

State Standards (12.3.1, 12.3.2, 12.3.4)

- Students will define taxonomy and how it ties various threads of biology together.
- Students will discuss binomial nomenclature as developed by Carolus Linnaeus and how it is viewed currently.
- Students will diagram the 7 levels of classification - kingdom, phylum, class, order, family, genus, species and how those fit within the current domain system.
- Students will organize the following terms in a collection to be presented to your peers: invertebrates, vertebrates, endo/exoskeleton, asymmetry, bilateral symmetry, radial symmetry, pseudocoelom, coelom, ecdoderm, mesoderm, endoderm, segmentation, aquatic, terrestrial, amniotic egg.
- Students will present to your peers the results of an in-depth study of a category of animals which ties together previous units on cells, heredity, and evolution.

FLOW OF MATTER AND ENERGY IN ECOSYSTEMS 12.3.3

SC.HB.7 Students will describe, on a molecular level, the cycling of matter and the flow of energy between organisms and their environment. They will explain how factors affect biological diversity, in populations, communities, ecosystems, and biomes. They will analyze human impact and its effect on the stability of the environment.

State Standards (12.3.3)

- Students will evaluate the importance of energy dynamics on populations and population growth. *12.3.3c*

- Students will compare and contrast populations, communities, ecosystems, biomes, and the biosphere. *12.3.3a, 12.3.3c*
- Students will diagram what happens to energy as it moves through the ecosystem. *12.3.3a*
- Students will discuss how ecological pyramids shape interactions that occur in ecosystems. *12.3.3a*
- Students will distinguish between predation and competition as interactions that shape ecosystems. *12.3.3a*
- Students will list examples of density dependent and independent limiting factors. *12.3.3a*
- Students will compare and contrast abiotic and biotic factors. *12.3.3d*
- Students will evaluate the effects biogeochemical cycles have on organisms within ecosystems. *12.3.3b, 12.4.2a*
- Students will define limiting nutrients and describe how they affect population growth. *12.3.3b*
- Students will describe the difference between the forms of organism interactions that occur in ecosystems. *12.3.3a*
- Students will analyze human activities and their effects on environmental quality. *12.3.3d*

Advanced Honors Biology

Advanced Honors Biology is modeled after an introductory college level biology course and targeted for the highly motivated student who is serious about pursuing a degree or career in the life science field. Students will evaluate, assess and contrast plant and animal cells, genetics including heredity, evolution, ecology and biochemical principles. Students will conduct a wide range of college level laboratory investigations using current technology as well as create a term paper on current biological research.

HEREDITY

SC.AHB.1 Students will analyze the molecular basis of reproduction, heredity and mutations by decoding information present in DNA and using the information to predict offspring possibilities.

State Standards (12.3.2)

- Students will demonstrate knowledge of Gregor Mendel's experimental protocols and the resulting data. 12.3.2
- Students will critically analyze the processes of mitosis and meiosis by completing a self guided tour of the material. 12.3.2
- Students will compare and contrast the Law of Segregation and the Law of Independent Assortment. 12.3.2
- Students will assess the importance of probability to an understanding of heredity. 12.3.2
- Students will compare and contrast incomplete dominance and co-dominance. 12.3.2
- Students will differentiate between pleiotropic and epistatic gene control. 12.3.2
- Students will distinguish between the various technological tools used in genetic testing and genetic counseling. 12.3.2
- Students will demonstrate and general understanding of the role the chromosome plays in inheritance. 12.3.2a
- Students will evaluate the importance independent assortment and crossing over have in producing genetic recombinants. 12.3.2c
- Students will diagram chromosome maps; including linkage maps and cytological maps. 12.3.2
- Students will examine special cases of chromosomal inheritance such as sex linked inheritance and non-disjunction to increase understanding of chromosomal disorders. 12.3.2
- Students will compare and contrasts deletion, duplication, inversion and translocation. 12.3.2
- Students will differentiate between aneuploid and polyploidy. 12.3.2
- Students will examine the principles of genomic imprinting to understand Fragile X syndrome. 12.3.2
- Students will analyze the historical aspects of the discovery of the shape of the DNA molecule to develop an understanding of the structure and function of DNA. 12.3.2a,b
- Students will explain and diagram the process of DNA replication. 12.3.2a,b
- Students will construct a diagram of the process of transcription which includes explanations of all pertinent steps in the process. 12.3.2
- Students will compare and contrast the role of the promoter and terminator in transcription. 12.3.2
- Students will describe the differences between introns and exons. 12.3.2
- Students will construct a diagram of the process of translation which includes explanations of all pertinent steps in the process. 12.3.2
- Students will discuss the importance of initiation and elongation to the process of translation. 12.3.2
- Students will analyze the role signal peptides play in locating of polypeptides in the cell. 12.3.2
- Students will describe new point mutations can affect protein structure and function. 12.3.2.b
- Students will analyze how insertions and deletions cause point mutations. 12.3.2b

- Students will describe frameshift mutations and their resulting disorders. 12.3.2b
- Students will discuss the effect of mutagens on causing mutations. 12.3.2b
- Students will discuss the importance of heterochromatin and euchromatin in the organization and control of eukaryotic genomes. 12.3.2
- Students will analyze Satellite DNA and its function in the genetic code. 12.3.2
- Students will discuss the process of gene amplification as it applies to the alteration of an organism's genome. 12.3.2
- Students will relate the process of mitosis to cancer. 12.3.2
- Students will discuss the effect of tumor-suppressor genes in cancer. 12.3.2
- Students will explain the role of mutations in the development of cancer. 12.3.2
- Students will compare and contrast the various forms of genetic engineering being utilized in current genetic research. 12.3.2
- Students will construct a concept map showing the steps associated with gene cloning. 12.3.2
- Students will describe the process of polymerase chain reaction as a method of cloning genes. 12.3.2
- Students will discuss the importance of gel electrophoresis in the isolation of genes. 12.3.2
- Students will discuss the role the human genome project has played in the understanding of ancestral DNA. 12.3.2

BIODIVERSITY

SC.AHB.2 Students will evaluate the theory of biological evolution by comparing and contrasting morphological, physiological, and behavioral adaptations necessary for survival. They will use the theory of natural selection to assess the changing diversity of life, with emphasis being placed on micro evolution and its effects on populations.

State Standards (12.3.4)

- Students will analyze the events in Darwin's life that led to the publishing of his book "On the Origin of Species". 12.3.4
- Students will differentiate between the contribution of congruent theories by Cuvier, Hutton, Lyell, Lamarck. 12.3.4
- Students will analyze Darwin's observations as stated in the Origin of Species. 12.3.4
- Students will distinguish between natural selection vs. artificial selection. 12.3.4
- Students will evaluate the supporting evidence for descent with modification. 12.3.4b
- Students will examine the effects that population genetics had on a developing evolutionary theory. 12.3.4b
- Students will defend the Hardy-Weinberg principle as it applies to a non-evolving population. 12.3.4b
- Students will compare and contrast micro evolution vs. macro evolution. 12.3.4b,c
- Students will critically analyze bottleneck, founder effect and gene flow as it relates to microevolution. 12.3.4
- Students will demonstrate an understanding of genetic variation as it applies to evolution. 12.3.4c
- Students will distinguish between Darwinian fitness vs. relative fitness. 12.3.4c
- Students will compare and contrast the various forms of selection that occur in populations. 12.3.4c
- Students will discuss pre and post zygotic barriers that effect speciation. 12.3.4c
- Students will differentiate between allopatric speciation and sympatric speciation. 12.3.4c

STRUCTURE AND FUNCTION OF LIVING SYSTEMS 12.3.1

SC.AHB.3 Students will analyze and apply the chemical basis of the growth, to the development, and maintenance of cells. They will relate the form and function of organelles that regulate

cellular activities as well as cellular functions to mitosis, photosynthesis, protein synthesis, and cellular respiration.

State Standards (12.3.1)

- Students will differentiate between catabolic pathways and anabolic pathways. 12.3.1b
- Students will discuss the role that free energy plays in cellular chemical reactions. 12.3.1b
- Students will compare and contrast exergonic and endergonic reactions. 12.3.1b
- Students will analyze the role of ATP in endergonic and exergonic reactions. 12.3.1b
- Students will describe how enzymes function during chemical reactions. 12.3.1b
- Students will critically analyze how enzymatic reactions are influenced within the cell. 12.3.1b
- Students will critique how metabolic control seems to be dependent on allosteric regulation. 12.3.1b
- Students will critically analyze the structures of the cell by completing a self guided tour of the material. 12.3.1 a, b
- Students will diagram cell membrane structure in animal cells. 12.3.1 a, b
- Students will assess how molecules move across membranes. 12.3.1 a, b
- Students will compare and contrast hypertonic and hypotonic cellular environments. 12.3.1b
- Students will distinguish between passive and active transport and co-transport. 12.3.1b
- Students will compare and contrast endocytosis vs. exocytosis. 12.3.1b
- Students will construct a concept map of cellular respiration, including fermentation. 12.3.1b
- Students will understand the role redox reactions play in cellular respiration. 12.3.1b
- Students will critically analyze glycolysis and the Krebs cycle to better understand how they connect to other metabolic pathways. 12.3.1b
- Students will analyze photosynthesis so as to be able to draw comparisons between cellular respiration in animal cells. 12.3.1b
- Students will compare and contrast the light and dark chemical reactions in photosynthesis. 12.3.1b
- Students will differentiate between Photosystem I and Photosystem II. 12.3.1b

FLOW OF MATTER AND ENERGY IN ECOSYSTEMS

SC.AHB.4 Students will describe, on a molecular level, the cycling of matter and the flow of energy between organisms and their environment. They will explain how factors effect biological diversity, in populations, communities, ecosystems, and biomes. They will analyze human impact and its effect on the stability of the environment.

State Standards (12.3.3)

- Students will demonstrate knowledge of the levels of organization within ecological systems. 12.3.3
- Students will analyze the various species distribution mechanisms as they apply to ecological systems. 12.3.3
- Students will compare and contrast abiotic and biotic factors and their effects on species distribution. 12.3.3a
- Students will develop an understanding of how population density affects ecosystems. 12.3.3
- Students will analyze demography as it applies to survivorship curves. 12.3.3
- Students will develop an understanding of exponential and logistic growth as it applies to populations. 12.3.3
- Students will compare and contrast k-selection and r-selection. 12.3.3
- Students will compare and contrast individualistic hypothesis and interactive hypothesis in community relationships. 12.3.3

- Students will compare and contrast interspecific interactions and intraspecific interactions within communities. 12.3.3
- Students will compare and contrast dominant vs. keystone species. 12.3.3
- Students will compare and contrast the forms of succession as it applies to community dynamics. 12.3.3
- Students will compare and contrast species richness and relative abundance. 12.3.3
- Students will analyze energy transfer within ecosystems as it relates to species distribution. 12.3.3
- Students will discuss primary production within ecosystems and factors that affect it. 12.3.3
- Students will discuss trophic efficiency by examining the various ecological pyramids. 12.3.3
- Students will differentiate between the various biogeochemical cycles. 12.3.3b
- Students will debate the effects that humans have on chemical cycles throughout the biosphere. 12.3.3c
- Students will discuss biological magnification as an example of negative human interactions. 12.3.3c

INQUIRY AND NATURE OF SCIENCE

SC.AHB.5 Students will design and conduct investigations using tools and technology that lead to the use of logic and evidence in the formulation of scientific explanations and models. They will evaluate and represent data collected in a systematic, accurate and objective matter to verify and refute hypotheses and to formulate revisions and alternative explanations.

State Standards (12.1.1)

- Students will evaluate, select, and correctly use equipment to conduct scientific experiments. 12.1.1d, 12.1.1e
- Students will create and conduct a controlled scientific investigation that models a testable hypothesis, and provides for opportunities to analyze, evaluate, and accurately present quantitative and qualitative data. 12.1.1a, 12.1.1b, 12.1.1c, 12.1.1e, 12.1.1f, 12.1.1g, 12.1.1h, 12.1.1i, 12.1.1j

CHEMICAL CONTEXT OF LIFE

SC.AHB.6 Students will demonstrate their understanding of atomic structure as it applies to molecules that are integral parts of living systems. They will compare and contrast the varying molecular characteristics of water and its role in dehydration and condensation reactions. They will be able to visually identify the functional groups that lead to the formation of macromolecules. They will analyze the characteristics of macromolecules and discuss their roles in living systems.

- Students will distinguish between an element and a compound. 12.2.3a
- Students will analyze how atomic structure determines the behavior of an element. 12.2.3d
- Students will describe how a change in atomic structure gives rise to isotopes. 12.4.4a, 12.2.3e
- Students will compare and contrast hydrogen, ionic, covalent, polar, and non polar bonding. 12.2.3a
- Students will discuss how water's polarity affects molecular interactions. 12.2.3a
- Students will distinguish between a solution, solute, and solvent. 12.3.3b.
- Students will list molecular characteristics that make water a good solvent. 12.2.3b
- Students will describe how the dissociation of a water molecule leads to a change in pH. 12.2.3a
- Students will evaluate the importance of carbon in life. 12.2.3a
- Students will differentiate between carbon skeletons and the functional groups they create. 12.2.3a
- Students will diagram the functional groups and list their corresponding functions. 12.2.3a
- Students will compare and contrast monomers and polymers. 12.2.3a

- Students will distinguish between dehydration and condensation reactions and discuss their role in forming macromolecules. *12.2.3a*
- Students will describe the characteristics of the four macromolecules and discuss their roles in living systems. 12.2.3a

Applied Chemistry

Students will qualitatively and quantitatively describe and calculate properties and amounts related to matter, reactions, atomic theory, solutions, carbon/earth chemistry and nuclear chemistry. They will apply scientific method to separate, identify, and quantify components in a mixture.

SC.AC.1 Students will utilize correct equipment, chemical disposal and safety procedures in the lab.

Unit 0 Introduction to Chemistry in the Community

- Students will summarize the safety requirements for the class, including submitting the correct form with appropriate signatures.
- Students will apply safety guidelines in the laboratory and be able to recognize safety concerns in an investigation
- Students will define chemistry and recognize its presence all around you.
- Students will develop a concept of community
- Students will describe the roles and responsibilities required when working in a group
- Students will make measurements of volume, length and mass and calculate density. 12.1.1e

SC.AC.2 Students will categorize matter and changes according to their different characteristics and use this knowledge to describe why we use what we do in our world.

Unit 1 A Why We Use What We Do

- Students will distinguish between chemical and physical properties & chemical and physical changes. 8.2.1
- Students will classify specific examples as either chemical or physical properties. 12.2.1
- Students will classify select elements and metals, nonmetals or metalloids based on the observations of chemical and physical properties. 8.2.1
- Students will use the periodic table to predict physical and chemical properties of an element. 12.2.1
- Students will use the periodic table to identify elements by their atomic masses and atomic numbers. 12.2.1
- Students will use the periodic table to locate period and groups of elements. 12.2.1
- Students will distinguish between isotopes based on their total neutrons and/or mass numbers. 12.2.1
- Students will calculate the mass number for an atom based on its total protons and neutrons. 12.2.1
- Students will explain how an element's chemical and physical properties are associated with the number and arrangement of electrons in its atoms. 12.2.1

Unit 1 B Earth's Mineral Resources

- Students will describe the Earth's atmosphere, hydrosphere, and lithosphere, including distribution of resources among them. 8.4.2c, 12.4.2a
- Students will describe or recognize factors that determine the feasibility of mining an ore at a specific site. 12.1.2b, 12.1.1g
- Students will explain why minerals of more active metals are more difficult to refine and process than mineral of less active metals. 12.2.1h
- Students will define oxidation and reduction in terms of apparent electron loss of gain. 12.2.1d
- Students will identify and distinguish between oxidation and reduction processes. 12.2.1d
- Students will represent oxidation and reduction processes using chemical equations electron dot structures. 12.2.1d

- Students will describe three common methods for separating metals from their ores, electrometallurgy, pyrometallurgy, and hydrometallurgy.)

Unit 1 C Conserving Matter

- Students will state and apply the Law of Conservation of Matter. 12.2.3i
- Students will relate balanced chemical equation so the Law of Conservation of Matter. 12.2.3i
- Students will write and explain balanced chemical equations. 12.2.3i
- Students will explain the usefulness of the mole concept in chemistry. 12.2.3i
- Students will calculate the molar mass of a compound.
- Students will calculate the quantities of reactants or products involved in chemical reaction, given a balanced equation. 12.2.3i
- Students will calculate percent composition.
- Students will distinguish between renewable and nonrenewable resources. 12.4.3c
- Students will identify methods of conserving Earth's resources. 12.4.2c

Unit 1 D Metals Designing for Desired Properties

- Students will explain allotropes in terms of the bonding and arrangement of an element's atoms. 12.2.1c
- Students will illustrate how alloys and their constituent elements differ in their chemical and physical properties. 12.2.1c
- Students will describe how the electrical conductivity of a material can be changed. 12.2.3j
- Students will describe and differentiate among methods for surface treatment of materials (coating, electroplating, thin films). 12.1.1, 12.1.2c

SC.AC.3 Students will describe properties of solids, liquids and gases according to kinetic theory

Unit 2 A Gases in the Atmosphere

- Students will identify the major components of the troposphere. 12.4.2a, 12.4.2a
- Students will describe how properties of the atmosphere change with increasing altitude. 12.8.2c
- Students will define and apply the concept of pressure, using various units. 12.8.3b
- Students will describe and apply the relationship between pressure and volume of a gas at a constant temperature. 12.2.1c, 12.2.3i
- Students will describe and apply the relationship between Kelvin temperature and volume of a gas sample at constant pressure. 12.2.1c, 12.2.3i
- Students will describe and apply the relationship between Kelvin temperature and pressure of a gas at constant volume. 12.2.1c, 12.2.3i
- Students will state and explain postulates of the kinetic molecular theory. 12.2.3j
- Students will state and explain Avogadro's law for gases. 12.2.3j
- Students will apply Avogadro's law in calculations, including stoichiometric problems. 12.2.3i
- Students will describe the behavior of an ideal gas. 12.2.3j, 12.2.1b
- Students will use the ideal gas law in problems involving gases. 12.2.3j, 12.2.1b, 12.2.3c

Unit 2 B Radiation and Climate

- Students will identify major types of electromagnetic radiation. 12.2.3g
- Students will describe the relationship between electromagnetic radiations energy, frequency and wavelength. 12.2.3g

- Students will describe how the Earth's atmosphere interacts with solar radiation. 12.4.3b
- Students will calculate thermal energy transferred between materials based upon their relative specific heat capacities. 12.2.3e, 12.1.11
- Students will explain how the greenhouse effect works, including typical gases involved and their main sources. 12.4.2a
- Students will discuss the carbon cycle and how natural or human factors can affect it. 12.4.2a, 12.4.3d

Unit 2 C Acids in the Atmosphere

- Students will explain why precipitation is naturally acidic and can become more acidic due to atmospheric contaminants. 12.2.1d
- Students will describe how certain gases can contribute to acid rain. 12.2.1g, 12.2.1d
- Students will define and describe characteristics of acids and bases. 12.2.1d
- Students will distinguish among strong and weak acids and bases. 12.2.1d
- Students will calculate and compare concentrations of hydronium (H_3O^+) and hydroxide ions (OH^-) in acidic, basic, and neutral solutions. 12.2.1d
- Students will describe, calculate, and compare pH values of acidic, basic and neutral solutions. 12.2.1d
- Students will describe effects of acidic precipitation (acid rain) and pH changes on natural systems. 12.2.1d, 12.4.2a, 12.4.2c
- Describe the composition and chemical behavior of a buffer. 12.2.1d

Unit 2 D Air Pollution: Sources, Effects, and Solutions

- Students will identify primary and secondary air pollutants and their sources. 12.4.2c
- Students will identify factors and contaminants that contribute to photochemical smog. 12.4.2c
- Students will describe personal and global strategies that may help reduce air pollution. 12.4.2c
- Students will describe the role of CFCs in stratospheric ozone depletion. 12.4.2c

SC.AC.4 Students will explain how petroleum is a vital part of our society and how it impacts us daily.

Unit 3 A Petroleum: What is it

- Students will describe the chemical makeup of petroleum and how it is refined. 12.4.3c
- Students will describe and give example of two primary uses for petroleum (energy source and raw material for synthesizing new substances). 12.4.2c, 12.4.3c
- Students will describe the use of distillation as a separation technique. 12.2.1b
- Students will describe fractional distillation and its application to petroleum refining. 12.2.1b
- Students will describe electron arrangement between covalently bonded atoms. 12.2.1a, 12.2.1c
- Students will represent covalent bonding in selected hydrocarbons with electron-dot, structural, and molecular formulas. 12.2.1a, 12.2.1c
- Students will identify and write formulas for alkanes.
- Students will define isomer and draw structural formulas for possible isomers of a particular hydrocarbon
- Students will predict and explain relative boiling points of hydrocarbons in terms of their intermolecular forces. 12.2.1b, 12.2.1c

Unit 3 B Petroleum: An Energy Source

- Students will distinguish between kinetic and potential energy. 12.2.3j
- Students will identify and give examples of kinetic energy and potential energy. 12.2.3j

- Students will explain endothermic and exothermic reactions in terms of total energy involved in bond breaking and bond making. 12.2.3k, 12.2.3d
- Students will draw and interpret potential energy diagrams representing endothermic and exothermic reactions. State, explain, and give example of the law of conservation of energy. 12.2.3k
- Students will describe energy conversion and energy conversion efficiency using examples. 12.2.3i
- Students will explain heat of combustion and specific heat capacity. 12.2.3e
- Students will use specific heat capacity values and experimental data to calculate molar heats of combustion. 12.1.1g
- Students will write balanced equations for combustion of specified hydrocarbons, including energy involved. 12.2.3i
- Students will define catalyst.
- Students will describe a catalyst's role in cracking large hydrocarbon molecules. 12.1.2b
- Students will describe octane rating and identify methods used to increase a fuel's octane rating. 12.1.2c

Unit 3 C Petroleum: A Building-Material Source

- Students will define and distinguish between monomer and polymer. 12.2.1a
- Students will explain how molecular structure affects physical properties of polymer. 12.2.1c
- Students will compare saturated and unsaturated hydrocarbons in terms of structure and properties. 12.2.1c
- Students will identify the functional groups in alcohols, ethers, carboxylic acids, and esters.
- Students will give examples of how functional groups impart characteristics properties to organic compounds.
- Students will identify and describe two major classes of ring compounds.
- Students will identify and describe the roles of addition and condensation reactions in polymerization.

Unit 3 D Energy alternative to Petroleum

- Students will describe major sources of energy used throughout history. 12.4.3a, 12.4.3c
- Students will describe and evaluate potential alternative sources of fuels and builder molecules. 12.4.3c
- Students will evaluate biodiesel as an alternative to petroleum-based diesel fuel. 12.4.3c
- Students will describe alternative-fuel vehicles in use or in development. 12.4.3c

SC.AC.5 Students will explain how water is a vital part of our society and how it impacts us daily.

Unit 4 Sources and Uses of Water

- Students will identify direct and indirect water uses, as well as example of each. 12.4.2a, 12.4.2c
- Students will describe water purification techniques. 12.4.2c
- Students will describe the hydrologic cycle. 12.4.2a
- Students will identify the main reservoirs of water on Earth. 12.4.2a, 12.4.2c

Unit 4 B Looking at Water and its Contaminants

- Students will define and identify examples of physical properties. 8.2.1b
- Students will classify sample of matter in terms of elements, compounds and mixtures. 8.2.1a
- Students will interpret and create models that represent elements, compounds, and mixture at the particulate level. 8.2.1a, 12.2.1f
- Students will distinguish among different types of mixtures (solution, colloids, & suspensions). 12.2.1c, 8.2.1a
- Students will recognize, describe, explain and distinguish among chemical symbols, formula and equations. 12.2.1a, 12.2.1f

- Students will recognize and distinguish characteristic of basic subatomic particles: protons, neutrons and electrons. 12.2.1g
- Students will describe what constitutes an ion. 12.2.1g
- Students will indicate the electrical charge of an ion containing a specified number of protons and electrons. 12.2.1g
- Students will write the formula and name of an ionic compound, given the compounds anion and cation name and electrical charge. 12.2.1a

Unit 4 C Investigating the Cause of the Fish Kill

- Students will define the terms insoluble, unsaturated, saturated, and supersaturated. 8.2.1e, 12.2.1c
- Students will quantitatively describe and predict solutions variables, including concentration, volume, temperature, mass of solute and solubility. 12.2.1c, 12.1.11
- Students will use the concept of polarity to account for water's ability to dissolve many ionic solids. 12.2.1a, 12.2.1c
- Students will describe the properties, as well as health and environmental effects, of heavy metals ions (particularly lead and mercury). 12.1.3f, 12.1.2b
- Students will give the pH of a solution, classify it as acidic, basic or neutral. 12.2.1d
- Students will describe the effect of intermolecular forces on a molecular substance's solubility in water. 12.2.1c
- Students will interpret and explain solubility curves. 12.2.1c
- Students will describe the effect of temperature and external pressure on solubility of gaseous substances. 12.2.1b, 12.2.1c

Unit 4 D Water Purification And Treatment

- Students will compare natural and municipal water purification. 12.4.2a
- Students will describe the problems associated with hard water ions and the processes of softening hard water. 12.1.2b
- Students will assess the risks and benefits of chlorination. 12.1.2c

SC.AC.6 Students will explain how nitrogen is a vital part of our society and how it impacts us daily.

Unit 5 A some Chemistry of Nitrogen

- Students will list the main elements found in fertilizer.
- Students will describe the effect of each ingredient in a typical fertilizer on plant growth. 12.3.3b, 12.2.1d
- Students will describe the nitrogen cycle, specifically referring to processes by which nitrogen gas is fixed (converted into nitrogen-containing compound). 12.4.2a
- Students will predict relative electronegativity trends among several elements. 12.2.1h
- Students will determine whether covalently bonded atoms exhibit positive or negative oxidation states, based on their electronegativity values. 12.2.1d

Unit 5 B Nitrogen and Industry

- Students will explain how temperature, reactant concentration(s), and the absence or presence of a catalyst affect reaction rates. 12.2.1e
- Students will describe characteristics of a system in dynamic equilibrium. 12.2.1e
- Students will use Le Chatlier's Principle to predict shifts in equilibrium caused by perturbation to a system. 12.2.1e
- Students will describe the Haber-Bosch process or industrial production of ammonia.

- Students will explain why many nitrogen-based compounds are effective chemical explosives.
- Students will describe the main goals of Responsible Care, Green Chemistry, and EPA standards.

Unit 5 C Metal Processing and Electrochemistry

- Students will describe the design of a voltaic cell.
- Students will use the activity series of metals to predict the direction of electron flow within particular voltaic cell. 12.2.1h
- Students will interpret, in terms of half-reactions describing oxidation and reduction, chemical processes by which batteries convert chemical energy to electrical energy. 12.2.1d
- Describe how electrolysis is used in industry (for example, to reduce aluminum cations to aluminum metal). 12.2.1d
- Students will use burden-benefit analysis in decisions about implementing chemical technologies. 12.1.1a

SC.AC.7 Students will use models and experiments to explain the development of the atomic model and then compare nuclear chemistry to conventional chemistry with real world applications.

Unit 6 A The Nature of Atoms

- Students will define and describe radioactivity. 12.4.1a, 12.4.1b (ADD BIG BANG), 12.2.3h
- Students will distinguish between ionizing and nonionizing radiation. 12.2.3h, 12.2.3f, 12.2.3g
- Students will describe the structure of the atom, including characteristics of the major subatomic particles (protons, electrons, & neutrons). 12.2.1f
- Students will Describe Rutherford's gold- foil experiment, including how its results led to a new model of the atom. 12.2.1f, 12.1.1k, 12.1.2c
- Students will define isotope and radioisotope. 12.2.1g
- Students will interpret a given isotope in terms of its atom's total protons and neutrons. 12.2.1g
- Students will calculate the average molar mass of an element, given isotopic molar masses and abundance data. 12.2.1f

Unit 6 B Nuclear Radiation

- Students will define and describe background radiation, including some of its sources. 12.2.3f, 12.2.3h, 12.4.4c, 12.4.4b
- Students will describe the effect of ionizing radiation on human tissue. 12.2.3i
- Students will distinguish among alpha, beta, and gamma radiation and their effects on living tissue. 12.2.3b, 12.2.3j
- Students will describe the effects of shielding, length of exposure, and proximity on the impact of alpha, beta and gamma radiation. 12.2.3h
- Students will describe how various radioactive emissions affect the composition of the nucleus. 12.2.3h
- Students will write, complete, and balance nuclear equations describing changes in composition of nuclei that are involve in radioactive emissions. 12.2.3i
- Students will list and describe methods for detecting and measuring ionizing radiation. 12.2.3h, 12.4.1b

Unit 6 C Using Radioactivity

- Students will define and describe half-life. 12.2.3h

- Students will give its half-life, calculate the amount of a particular radioisotope that remains after a specified time. 12.2.3h, 12.4.4b
- Students will describe how radioisotopes are used as diagnostic tracers in medicine. 12.1.3g
- Students will describe how radioisotopes are used to kill cancerous cells. 12.1.3g
- Students will describe the process of nuclear transmutation. 12.2.3i
- Students will write, complete, and balance nuclear transmutation equations. 12.2.3i

Unit 6 D Nuclear Energy: Benefits and Burdens

- Students will define and describe nuclear fission. 12.4.1b
- Students will write a balanced nuclear equation for a fission reaction. 12.2.3i
- Students will describe how electricity is generated in a nuclear power plant
- Students will define and describe nuclear fusion. 12.4.1b
- Students will list and describe types of nuclear waste, including their sources. 12.1.3g
- Students will list, describe, and evaluate methods for disposal of nuclear wastes, including burdens and benefits of each. 12.4.3c

SC.AC. 8 Students will analyze the food we eat and relate this to chemistry and how it impacts humans and our society.

Unit 7 A Food as Energy

- Students will describe how calorimetry is used to determine the energy stored in a particular food
- Students will calculate energy involved, temperature change, or specific heat capacity given appropriate calorimetry data. 12.1.11
- Students will describe main processes and reactions involved as energy flows from the sun to the growing plants, then in turn to herbivores, carnivores, and decomposers. 12.3.1c, 12.3.3b
- Students will describe how chemical energy is derived from oxidation of carbohydrates and fats. 12.2.1d

Unit 7 B Energy Storage and Use

- Students will describe the general structure of a carbohydrate molecule. 12.2.1g
- Students will distinguish among monosaccharide, disaccharide, and polysaccharide structures.
- Students will describe the general structure and components of a fat molecule. 12.2.1g
- Students will describe saturated and unsaturated fats. 12.2.1g
- Students will describe hydrogenation.
- Students will distinguish between cis and trans isomers.
- Students will explain how structural differences in fat and carbohydrate molecules account for their different properties and energy content. 12.2.1e
- Students will identify a limiting reactant, given the equation and reaction conditions. 12.2.3i

Unit 7 C Proteins, Enzymes, and Chemistry

- Students will describe the general structure of a protein molecule. 12.3.1a
- Students will describe the formation of a peptide bond. 12.2.1a
- Students will describe how amino acids in food are converted to proteins within the body. 12.3.1c
- Students will describe how some protein molecules (enzymes) serve as catalyst. 12.2.1e
- Students will describe the effect of temperature and pH on enzyme's catalytic behavior. 12.2.1e

Unit 7 D Other Substances in Foods

- Students will describe how some vitamins act as coenzymes within the body. 12.3.1c

- Students will explain why a particular vitamin is either fat-soluble or water-soluble.
- Students will describe how titration can be used to determine the amount of solute in a particular solution. 12.2.1e
- Students will list key mineral and explain their importance to the body.
- Students will list and describe main uses of food additives.
- Students will describe how paper chromatography separates and identifies mixture components. 12.2.1c

Chemistry

Students will qualitatively and quantitatively describe/calculate properties/amounts related to matter, reactions, atomic theory, solutions, equilibrium and nuclear chemistry.

SC.CH.1 Students will utilize correct equipment, chemical disposal and safety procedures in lab.

- Students will obtain and set up lab equipment and chemicals required for experiments.
- Students will dispose of chemicals in designated containers.
- Students will wear/utilize safety equipment/procedures in lab.
- Students will organize equipment, using safety procedures and disposal techniques to execute a lab.

SC.CH.2 Students will categorize matter and changes according to their different characteristics.
State Standards (12.2.3c)

- Students will define chemistry and state why it is studied.
- Students will classify matter as element, compound, heterogeneous mixture or solution.
- Students will differentiate between physical and chemical properties and physical and chemical changes.
- Students will list 5 evidences of chemical change.
- Students will identify reactants and products in a chemical reaction.
- Students will apply the Law of Conservation of Mass.
- Students will apply the Law of Constant Proportion to chemical change.
- Students will identify metal, nonmetal and metalloid from the periodic table.
- Students will identify three common lab gases as produced in reactions.
- Students will separate matter and changes into categories according to their characteristics.

SC.CH.3 Students will convert units using correct dimensional analysis techniques and cite the answer using correct significant figures. Correctly measure length, volume, mass and temperature using significant figures with different measuring instruments.

- Students will distinguish between quantitative and qualitative measurements.
- Students will convert floating decimal numbers to and from scientific notation.
- Students will calculate percent error.
- Students will identify the number of significant figures in a measurement and in the results of a calculation.
- Students will measure to the correct decimal position using rulers, graduated cylinders, thermometers and balances.
- Students will list SI units of measurements and common SI prefixes.
- Students will solve for all variables in the density formula.
- Students will cancel units in calculations.
- Students will construct conversion factors from equivalent measurements.
- Students will apply techniques of dimensional analysis to a variety of simple and complex conversions and measurements.

SC.CH.4 Students will name, balance and classify compounds according to their structures and relate them to real world issues.

State Standards (12.2.3.e)

- Students will distinguish between molecular compounds, ionic compounds, acids and bases.
- Students will identify diatomic elements from the periodic table.
- Students will distinguish between an atom, ion, molecule, and formula unit.
- Students will determine the charge or oxidation number for an element of a polyatomic ion or compound.
- Students will write balanced formulas for compounds from charges and names and vice-versa.
- Students will balance, name and classify compounds and assess their usage in the real world.

SC.CH.5 Students will solve for chemical quantities using mole computations and conversions.

- Students will describe how Avogadro's number is related to a mole of any substance.
- Students will use the mole to convert among measurements of mass, volume, and number of particles.
- Students will calculate the percent composition of a substance or hydrate from its chemical formula or experimental data.
- Students will derive the empirical formula and the molecular formula of a compound from experimental data.
- Students will use mole calculations and conversions to solve for chemical quantities.

SC.CH.6 Students will differentiate between and complete 5 types of chemical reactions

- Students will write equations describing chemical reactions using appropriate symbols.
- Students will balance chemical equations.
- Students will use the activity series and solubility table in appropriate reactions.
- Students will identify and complete reactions as combustion, oxidation, dissociation, single displacement, double displacement.

SC.CH.7 Students will compute reaction stoichiometry using moles, mass and energy.

- Students will interpret coefficients as mole ratios.
- Students will calculate quantities from balanced chemical equations using moles, grams, liters, or energy.
- Students will identify and use limiting reagent in a reaction to calculate the maximum amount of products produced and the amount of excess reagent.
- Students will calculate theoretical yield, actual yield, or percent yield given appropriate information.
- Students will compute stoichiometric relationships using mass, mole and energy.

SC.CH.8 Students will order and evaluate discoveries and experiments in atomic theory from 1800 to the present, predicting the present day model of the atom with properties of the three basic subatomic particles.

State Standards (12.2.3.d, 12.2.3.e)

- Students will summarize Dalton's atomic theory.
- Students will describe the size of an atom.
- Students will distinguish among protons, electrons and neutrons in terms of relative mass, charge and position.
- Students will describe the structure of the atom.
- Students will explain how atomic number identifies an element.

- Students will use atomic number and mass number to compute numbers of protons, electrons, and neutrons.
- Students will explain how isotopes differ and why atomic masses are not whole numbers.
- Students will relate wavelength and energy to each other using photoelectric effect.
- Students will relate wavelength, energy and atomic emission spectra to the quantum mechanical model of the atom.
- Students will draw and write electron configurations of atoms and ions.
- Students will write valence configurations for atoms and ions.
- Students will relate octet rule to stability of atoms and ions.
- Students will explain exceptions to electron configuration based on stability.
- Students will express the present day model of the atom with its particles using discoveries and experiments in atomic theory.

SC.CH.9 Students will predict physical and chemical properties of elements based on periodic table trends.

State Standards (12.2.3.f)

- Students will describe origin and development of the periodic table.
- Students will identify groups, periods and sections on the periodic table.
- Students will interpret ionization energy trends on the PT.
- Students will characterize metals vs. nonmetals vs. metalloids for size, ionization energy and activity.
- Students will predict physical and chemical properties of elements based on PT trends.

SC.CH.10 Students will predict bond types in and therefore properties of compounds from periodic table placement of elements in compounds and properties observed in lab.

State Standards (12.2.3.a)

- Students will describe four types of internal bonds as metallic, ionic, covalent or network.
- Students will explain what holds the bond together between elements in a compound.
- Students will predict properties such as melting point, solubility, conductivity, and appearance of the four bond types.
- Students will draw electron dot structures for covalently bonded molecules.
- Students will predict polarity of molecules based on symmetry.
- Students will predict properties of molecules based on their polarities.
- Students will classify substances as one of the four bond types from PT placement or properties observed in lab.

SC.CH.11 Students will compute changes in volume, pressure, temperature, moles and velocity of gases using gas laws.

- Students will describe motion of gas particles according to the kinetic theory.
- Students will convert between different units of pressure, volume, and temperature.
- Students will use Boyles Law, Charles Law, the Combined Gas Law and the Ideal Gas Law to compute changes in volume, pressure, temperature, moles and relative velocity of gases.

SC.CH.12 Students will differentiate properties of solutions from their solvents qualitatively and quantitatively.

- Students will explain the solubility rule, “Like dissolves like”.
- Students will predict which solutions contain ions and which do not.
- Students will solve molarity, molality, dilution, titration, freezing point depression and boiling point elevation problems.
- Students will perform titrations in lab.
- Students will calculate pH, pOHs, [H⁺], [OH⁻] of strong acid and base solutions.
- Students will explain why solutions have lower vapor pressures, lower freezing points and higher boiling points than pure solvents.
- Students will differentiate between solutions and solvents using properties and calculations.

SC.CH.13 Students will compare reversible to irreversible reactions, predicting equilibrium shifts and calculating constants.

- Students will explain what is meant by reaction rate and how to measure it.
- Students will identify endothermic and exothermic reactions by graph and in lab.
- Students will use collision theory, explain how four factors affect chemical reaction rates.
- Students will distinguish between reversible and nonreversible reactions.
- Students will define equilibrium in a closed system for reaction concentrations.
- Students will predict changes in equilibrium position using Le Chatelier’s Principle.
- Students will write an equilibrium expression from an equilibrium reaction.
- Students will calculate the equilibrium constant or the concentrations of reactants or products using the constant.
- Students will predict how outside influences change the equilibrium position by predicting shifts in an equilibrium system and calculating equilibrium constants.

SC.CH.14 Students will compare conventional chemistry to nuclear chemistry. Students will critique nuclear applications in the real world, such as, nuclear processes used in medicine, energy production, warfare, object dating, etc.

- Students will differentiate between chemical and nuclear change, and ionizing and non-ionizing radiation.
- Students will list the three types of radiation emitted from unstable nuclei and write equations representing nuclear decay.
- Students will explain the difference between radioactive material and radiation.
- Students will calculate quantities and time lines of radioactive material using half-life.
- Students will explain how radioactive isotopes can be man-made.
- Students will explain the significance of mass defect and binding energy.
- Students will distinguish between fission and fusion.
- Students will explain how a nuclear power plant works.
- Students will explain the problems involved with nuclear waste disposal in the .

AP Chemistry

Students will qualitatively and quantitatively describe/calculate properties/amounts related to matter, reactions, thermo-chemistry, atomic theory, intermolecular forces, solutions, equilibrium, entropy and beginning organic chemistry on a freshman college level.

SC.APC.1 Students will utilize equipment, LabQuests/probes, chemical disposal and safety procedures in lab.

- Students will obtain and set up lab equipment, LabQuests/probes, and chemicals required for experiments.
- Students will dispose of chemicals in designated containers.
- Students will wear/utilize safety equipment/procedures in lab.
- Students will organize equipment, using safety procedures and disposal techniques to execute a lab.

SC.APC.2 Students will convert units on a college level using correct dimensional analysis techniques and cite the answer using correct significant figures.

- Students will solve multi-step conversion problems using techniques learned in Chemistry I.
- Students will utilize significant figure techniques learned in Chemistry I to express answers.
- Students will calculate answers to complex problems using dimensional analysis and significant figure rules.

SC.APC.3 Students will calculate amounts related to the mole.

- Students will calculate average atomic masses and relative isotopic abundances from pertinent data.
- Students will calculate stoichiometric amounts from equations on a college freshman level using the mole.
- Students will calculate stoichiometric amounts from equations using molarity of solutions.

SC.APC.4 Students will complete chemical equations.

- Students will complete net ionic equations for single and double displacement reactions.
- Students will identify, describe and complete oxidation-reduction equations.
- Students will complete college level equations.

SC.APC.5 Students will describe the uses of electrochemistry in the world.

- Students will describe and construct a voltaic cell with its calculations.
- Students will describe the oxidation/reduction processes and how they complement each other.
- Students will describe and construct an electrolytic cell with its calculations.
- Students will describe how corrosion occurs.
- Students will summarize the use of chemical reactions to produce electric current and visa versa.

SC.APC.6 Students will explain the chemistry of energy production and exchange with its calculations.

- Students will calculate enthalpy of a reaction using standard states and standard enthalpies of reactants and products and vice-versa.
- Students will use Hess's Law to calculate enthalpy changes for a variety of reactions.
- Students will interpret endothermic and exothermic reaction graphs.
- Students will relate enthalpy changes in reactions to real world problems.

SC.APC.7 Students will develop the modern picture of the atom from history.

- Students will solve problems related to wavelength, frequency, energies of electrons in energy levels, deBroglie masses from wavelengths.
- Students will state the relationships between frequency and wavelength, photoelectric effect and photon strength, and energy and frequency.
- Students will describe the atom using wave-particle duality.
- Students will describe the use of quantum numbers in locating electrons in an atom.
- Students will describe the nature of the present day atom using historical notes.

SC.APC.8 Students will relate electronic structure and periodic trends to bonding.

- Students will relate electronegativity to bonding.
- Students will use Lewis dot structures to predict polarity and shapes of molecules.
- Students will draw and predict resonance structures of molecules.
- Students will predict molecular shapes and properties using Lewis structures.

SC.APC.9 Students will describe the effects of intermolecular forces on properties of substances.

- Students will list intermolecular forces present in differently bonded substances.
- Students will interpret phase diagrams.
- Students will describe the effects of IFs on melting point, boiling point, surface tension and evaporation rate.

SC.APC.10 Students will describe properties of solutions with their calculations.

- Students will review miscibility rules.
- Students will predict solubility from Lewis structures.
- Students will calculate molalities of solutions.
- Students will order a list of solutions using their particle molarities.
- Students will solve problems relating to the colligative properties of boiling point elevation, freezing point depression and vapor pressure change.

SC.APC.11 Students will predict how factors change reaction rates and make kinetics calculations.

- Students will review factors that affect reaction rates.
- Students will determine rate laws and constants from data.
- Students will determine reaction order from data and graphs.
- Students will evaluate reaction mechanisms, molecularity and rate determining step.
- Students will state the criteria for collision theory.
- Students will solve problems relating to activation energy.
- Students will use kinetics data to evaluate a reaction.

SC.APC.12 Students will list characteristics of reactions at equilibrium and make calculations involving equilibrium at the college level.

- Students will review factors affecting equilibrium shifts.
- Students will solve for equilibrium constants and concentrations when given appropriate data.
- Students will use the reaction quotient to predict the direction of chemical reactions toward equilibrium.
- Students will calculate K_{sp} and concentrations in precipitate solutions.
- Students will solve equilibrium problems and test assumptions made in terms of shifting and mathematical quantities.

SC.APC.13 Students will identify properties and Arrhenius, Bronsted and Lewis acids and bases and make accompanying calculations.

- Students will define and describe Arrhenius acids and bases.
- Students will describe the actions of common indicators in these solutions.
- Students will define and identify conjugate Bronsted acid-base pairs.
- Students will write equilibrium expressions for acid, base and salt dissociations.
- Students will calculate pHs and concentrations in weak acid, base solutions.
- Students will convert among pH, pOH, $[H^+]$ and $[OH^-]$ in strong and weak acid/base solutions and polyprotic acid solutions.
- Students will predict acidity or basicity of salt solutions.
- Students will complete acid/base reactions.
- Students will identify Lewis acids/bases.
- Students will predict the effect of an addition of a common ion on an acid base solution.
- Students will determine the effects of additions to a buffer solution.
- Students will demonstrate titration techniques in lab along with indicator choice.
- Students will distinguish between acids, bases and salts in solution and on paper with calculations.

SC.APC.14 Students will use thermodynamics to predict whether or not a reaction will occur.

- Students will predict entropies of comparative reactions.
- Students will explain the importance of changes in enthalpy to changes in entropy.
- Students will calculate the change in entropy in a reaction.
- Students will relate free energy and spontaneity.
- Students will interconvert between K and free energy.
- Students will calculate the free energy change in a reaction and use it to predict spontaneity of said reaction.

SC.APC.15 Students will use lab skills to design a lab identifying unknowns.

- Students will design a flow chart to separate three heavy metals in a solution.
- Students will pick chemicals used to identify 5-8 solid unknowns.
- Students will design a method to identify 10 unknown solutions by reacting them with each other.

SC.APC.16 Students will list properties/names of elementary organic compounds, completing simple reactions.

- Students will identify simple hydrocarbons.
- Students will draw and name simple isomers.
- Students will list how organic chemistry is different from inorganic chemistry.
- Students will indicate functional groups on substituted hydrocarbons with notes.
- Students will complete simple hydrocarbon reactions.
- Students will explain how polymers are constructed.
- Students will differentiate between organic compounds/chemistry and inorganic compounds/chemistry.

Physics

Students will demonstrate understanding and applications/analysis of motion, Newtonian mechanics, Work, Energy, and Heat transfer/rates, as well as wave characteristics and interactions.

SC.PH.1 Students will solve mathematical problems using algebra and trigonometry. (algebraic manipulation, dimensional analysis, proportions, and trigonometry (right and non-right triangles)).

- Students will re-arrange algebraic equations for numerical and unit equivalence.
- Students will convert standard numbers to scientific notation and vice versa and calculate with scientific notation.
- Students will solve problems using dimensional analysis and proportions.
- Students will solve problems using trigonometry in either right or non-right triangles.

SC.PH.2 Students will apply procedural, mathematical and graphical processes to scientific experimentation.

- Students will solve conversion problems to make data usable in standard equations.
- Students will analyze potential errors in experimental data taking, calculate percentage differences, and analyze graphs for linear vs. non linear relationship.
- Students will analyze measurement and calculation results for correct significant digits.
- Students will apply types of variables in experiments.
- Students will predict linear vs. non linear graphs based on equations.
- Students will apply procedural, mathematical and graphical processes to scientific experimentation.

SC.PH.3 Students will apply equations and analyze motion, constant and uniformly accelerated, in a straight line.

- Students will define and apply the relativity of motion.
- Students will define scalars vs. vectors and compare and contrast distance, position, displacement, average and instantaneous speed and velocity, and acceleration.
- Students will apply equations and analyze motion, constant and uniformly accelerated, in a straight line.

SC.PH.4 Students will evaluate real world situations/problems using vector addition or vector components.

- Students will review the definitions of scalars vs. vectors.
- Students will define and apply graphical methods of depicting real world situations.
- Students will define and apply the independence of vector quantities to real world events.
- Students will define and apply mathematical techniques of addition for 2 or more vectors.
- Students will define and apply the concepts of equilibrium and equilibrants as they pertain to vectors.
- Students will define and apply perpendicular components of vectors.
- Students will evaluate real world situations/problems using vector addition or vector components.

SC.PH.5 Students will apply fundamental forces and their interaction with matter according to Newton's Laws of Motion.

- Students will list and define the fundamental forces.
- Students will define and apply Newton's laws.
- Students will calculate the relationships between net force, mass and acceleration using Newton's second law and apply this to weight of objects in the vertical.
- Students will compare and contrast mass vs. weight.
- Students will define and calculate friction.
- Students will apply the concept of friction as it determines net force and acceleration in calculations of Newton's Second Law.

SC.PH.6 Students will apply the independence of vectors quantities and combinations of formulae to solutions of motion in 2 different directions.

- Students will explain how Newton's 1st Law and the independence of vector quantities extends to motion in two directions to produce curved motion.
- Students will utilize equations of motion to calculate the resultant motion of objects moving in a curved path when projected horizontally.
- Students will utilize equations of motion and perpendicular components of vectors to calculate the resultant motion of an object launched from the ground at an angle.
- Students will generate and utilize equations of uniform circular motion.
- Students will define and apply the concepts of Simple Harmonic Motion to sound/music and building architecture.
- Students will generate an equation and calculate the period of a pendulum. Apply this to time keeping.

SC.PH.7 Students will utilize Universal Gravitation and previous Newton's Laws and motion equations to calculate interactions between objects (masses).

- Students will explain Kepler's 3 Laws of Planetary Motion.
- Students will generate and utilize Newton's Universal Law of Gravitation from Kepler's 3rd Law equation and previously learned centripetal force equations and Newton's 3rd Law of Motion.
- Students will explain the Correlation Principle by testing the predictions of Newton's Gravitation Equation against previously known information about the motion of the moon around the earth.
- Students will generate and utilize an equation from the Universal Gravitation Equation and the Weight Equation (a derivative of Newton's Second Law) to all calculation of the acceleration of gravity on any planet and the mass of the earth.
- Students will combine equations learned and reviewed in this chapter to generate and apply equations which describe satellite motion. This also includes equations for geostationary orbits for satellite TV, communication, and weather monitoring.

SC.PH.8 Students will calculate interactions between objects using Momentum, Impulse, and Conservation of Momentum.

- Students will define momentum and its simplest equation. Apply this formula to force and motion equations previously learned.
- Students will generate and utilize the Impulse-Momentum Theorem.
- Students will define, generate, and utilize the equation for the Law of Conservation of Momentum.
- Students will apply the Law of Conservation of Momentum to the game of pool and ballistics.

SC.PH.9 Students will calculate work, work at an angle, and the rate of work (power) in object interactions.

- Students will define the quantity of Work and apply its formula to real world situations.
- Students will apply the quantity of work at an angle to the object with geometry and trigonometry.
- Students will define, generate, and apply the formula for power.

SC.PH.10 Students will utilize concepts of energy and the conservation of energy to calculate and predict interactions between objects.

- Students will define the equivalence of work and energy.
- Students will categorize various types of energy into the 2 basic forms – Kinetic and Potential.
- Students will define and generate an equation for the Work-Energy Theorem.
- Students will define, generate, and apply a formula for Kinetic Energy.
- Students will define and categorize the various forms of Potential Energy – Chemical, Elastic, and Gravitational.
- Students will define, generate, and apply equations for Elastic and Gravitational Potential Energy.
- Students will define, generate, and apply equations for the Law of Conservation of Energy.
- Students will utilize previously discussed motion formulae in conjunction with the Law of Conservation of Energy to predict changes in motion of interacting objects.

SC.PH.11 Students will utilize temperature, mass, and specific heat measurements to calculate heat transfer and conservation of heat when objects/substances interact.

- Students will define and categorize the terms: Temperature, Heat, Thermal Energy, Internal and External Energy.
- Students will define several methods of measuring temperature.
- Students will define the 3 primary temperature measuring systems – Fahrenheit, Celsius, and Kelvin.
- Students will apply temperature conversion formulae between the 3 temperature measurement systems.
- Students will define the First Law of Thermodynamics.
- Students will define the Second Law of Thermodynamics.
- Students will compare and contrast English and International System units of Heat and Heat transfer.
- Students will define the quantity of Specific Heat and apply it to real world heat exchanges.
- Students will generate and apply a formula for heat exchange between objects/substances.
- Students will generate and apply a formula for the Law of Conservation of Heat (Energy) when substances are mixed.
- Students will define the process of change of state in substances. Generate and apply the formulae unique to these situations.
- Students will calculate the total heat exchanged when substances go through one or more changes of state.

SC.PH.12 Students will categorize waves by characteristics and compare wave behavior within substances and at boundaries. Calculate wave velocity.

- Students will compare and contrast particle vs. wave transfer of energy.
- Students will categorize waves by whether they need a substance to travel through and how they disturb the substance if they need one.
- Students will define characteristics of all waves such as wavelength, frequency, and period.

- Students will generate and apply formulae for the speed of waves.
- Students will define how wave speed is dictated by the substance it travels through.
- Students will compare and contrast how wave characteristics are changed when they reach a boundary into a new substance.
- Students will define how waves affect each other when more than one of them travel through the same substance at the same time.
- Students will compare and contrast Reflection, Refraction, and Diffraction.
- Students will define the Doppler Effect and apply it to vehicle speed enforcement, weather observation, astronomy etc.

SC.PH.13 Students will utilize the Law of Reflection and Snell’s Law of Refraction to compute light ray behavior in and between substances.

- Students will compare and contrast diffuse vs. regular reflection.
- Students will define the rule of refraction as waves approach substance boundaries and bend.
- Define the Snell’s Law equation and apply it to wave bending between substances.
- Students will generate and apply an equation for the speed change of a wave based on refraction.
- Students will define Total Internal Reflection and apply this principle to elementary optics, computer data transfer, and atmospheric phenomena.
- Students will apply refraction to things such as water mirages, rainbows, and “heat waves.”

Physics II/Astronomy

Students will demonstrate understanding and applications/analysis of optics, celestial mechanics, astronomical equipment and observing techniques, stellar classifications, cosmology, and electricity.

SC.PA.1 Students will construct ray diagrams and calculate focal lengths, focal points, magnifications etc for various optical configurations.

- Students will apply the principle of regular reflection to flat mirror and the images they produce.
- Students will define terms such as the Principal Axis, Center/Radius of Curvature, Focal Point and, and Focal length to apply rules of ray behavior to predict image type, size/magnification, and position for concave and convex mirrors.
- Students will define spherical aberration and its effect on image quality in optical applications.
- Students will generate the optics equation and apply it to curved mirror to calculate the image size, position, magnification, and predict its project ability.
- Students will apply the optics equation and principles similar to those for mirrors, to lenses.
- Students will define Chromatic Aberration and its effects on image quality in optical applications.
- Students will apply systems of lens and/or mirrors for use in telescopes, cameras etc.

SC.PA.2 Students will compare and contrast true and apparent motions of objects in the sky. Analyze lunar and planetary phases, and eclipses.

- Students will define a constellation including the cultures that first created them.
- Students will apply the principle of parallax to produce apparent stellar motions in the sky.
- Students will define extensions of earth's geographic features into the sky such as the Celestial Poles, Celestial Equator as well as other geometric features of the sky including the Celestial Meridian, Zenith, Nadar.
- Students will define the terms anti and post meridian (AM and PM).
- Students will compare the types of "time" – Standard Time, Local Time, Universal Time.
- Students will apply the principle of parallax due to the motion of the earth around the sun to compare and contrast a Solar Day vs. a Sidereal Day.
- Students will define the reason for the earth's seasonal changes.
- Students will define the Analemma.
- Students will define the ecliptic, the zodiac, and the obliquity of the ecliptic as well as the equinoxes and solstices. Apply knowledge of these terms to predict the length of the day and highest point from the zenith and nearest horizon for the sun at specific latitudes.
- Students will define the Precession of the Equinoxes and how this changes the location of the Celestial Poles.
- Students will compare and contrast the celestial coordinate system with that used on the earth.
- Students will compare and contrast the moon's real and apparent motions in the sky.
- Students will define and diagram lunation (phase) cycles.
- Students will compare and contrast Lunar vs. Solar eclipses.

SC.PA.3 Students will distinguish between types of optical and non optical telescope and mountings. Compare and contrast their applications for amateur and professional astronomers.

- Students will compare and contrast real world applications for amateur telescopes vs. the misconceptions most people have.
- Students will explain the physiology and biochemical nature of the human eye and how this affects observing visually through a telescope.
- Students will compare and contrast the reflector vs. the refracting telescope including advantages and disadvantages of each type in astronomical applications.
- Students will compare and contrast the many different types of reflector telescopes including the advantages and disadvantages of each.
- Students will compare non-conventional optical designs invented by amateur astronomers.
- Students will compare and contrast altitude azimuth (Dobsonian) vs. Equatorial mountings for telescope.
- Students will compare and contrast different equatorial mounts for telescopes.
- Students will compare and contrast atmospheric and physical characteristics of telescope compositions in their application for astronomy.
- Students will describe accessories for telescopes which can enhance their function.
- Students will compare and contrast optical vs. non-optical telescopes used for various types of astronomical research.

SC.PA.4 Students will compare and contrast the planets and solar system objects as seen from earth. Distinguish between various among various astronomical and meteorological phenomena (e.g. Aurorae, zodiacal light etc.) visible in the night sky.

- Students will compare and contrast the appearance of stars vs. planets in the night sky – with and without a telescope.
- Students will diagram locations of the planets relative to the sun and earth at Conjunction (Superior and Inferior), Opposition, and Elongation.
- Students will define the accretion theory and differentiation with regard to the formation of the solar system.
- Students will compare and contrast the different types of twilight.
- Students will define, compare and contrast the Zodiacal Light, Zodiacal Band, Skyglow, and Gegenschein.
- Students will define the “Dirty Snowball” theory of comet formation and the Oort Cloud
- Students will define the various portions of a comet.
- Students will compare and contrast the orbits of comets and apparitions of comets compared to other solar system objects.
- Students will define cometary “propulsion causing a degree of unpredictability as well as gravitational interactions that can cause planetary collisions.
- Students will define the Aurora Borealis/Australis and the conditions needed to form them.
- Students will compare and contrast meteoroids, meteors, and meteorites. Explain the dynamics of a meteor shower/storm.

SC.PA.5 Students will conduct research and teach a presentation on a planet or dwarf planet in the solar system.

- Students will once chosen or assigned a planet or solar system object, the student or group will prepare a minimum 2 block rubric based presentation using PowerPoint.
- Students will prepare measurable objectives for their presentations.
- Students will prepare enrichment activities including note packets, web queries, and guided readings .
- Students will create a bibliography of material used in research for their presentation.

- Students will administer an assessment based on their objectives.
- Students will take an assessment based on the cumulative assessments given by all groups and students.

SC.PA.6 Students will classify stars by magnitude, types of multiple systems (if applicable), variability, and spectrum. Students will be able to classify various deep sky objects (beyond our solar system.)

- Students will define the types of stellar/object magnitudes. Calculate magnitude, luminosity, or distance given any 2 of the three variables.
- Students will define a parsec and apply the sine function in trigonometry to calculate the distance to stars.
- Students will define binary stars as True, Optical, or Spectroscopic.
- Students will define a Cepheid variable star and how they are used to calculate the distance to stars which are too far away to use parallax.
- Students will compare and contrast the main spectral types of stars and their relation to stellar “life expectancy”.
- Students will compare and contrast the 2 main types of star clusters – open/galactic vs. globular.
- Students will compare and contrast the various types of nebulae.
- Students will define a planetary nebula and compare it to other types of nebulae.
- Students will define a supernova remnant, a neutron star, and a pulsar.
- Students will compare and contrast galaxies using the Hubble classification scheme.
- Students will define quasars.
- Students will define Olber’s Paradox.
- Students will define the Hubble Constant and its application in determining the size and age of the universe.

SC.PA.7 Students will outline charge movement, and distribution within objects to create electric forces. Calculate electric force by using Coulomb’s Law.

- Students will define the charging of objects as it relates to atomic structure.
- Students will compare and contrast methods of charge transfer.
- Students will describe how a charged object can apply a force on a neutral object.
- Students will define Grounding and how it applies to electronic devices.
- Students will describe how charges are distributed within a charged object and predict locations where charges are most likely released or accepted.
- Students will define the fundamental unit of charge – the coulomb.
- Students will generate and apply the Coulomb’s Law equation to calculate forces exerted between charged objects.

SC.PA.8 Students will analyze electric fields and calculate their intensities. Calculate voltage and capacitance.

- Students will define an electric field and its effect on charges within it.
- Students will generate and apply the equation for electric field intensity.
- Students will compare and contrast electric field lines with topographic contour lines or isobars of pressure used for weather analysis.
- Students will compare and contrast accelerations of charged masses within an electric field to masses accelerated by gravitational fields.

- Students will generate and apply the equation of voltage within an electric field.
- Students will generate and equation for voltage as the energy needed (or released) as a charged object moves through an electric field.
- Students will define a capacitor and their function within electronic devices.
- Students will generate and apply the formula for Capacitance stored within a capacitor.

SC.PA.9 Students will utilize equations for electrical power, Ohm’s Law, Heating in circuits, and electrical work. Distinguish between series and parallel circuits and create samples of each from diagrams.

- Students will define the terms: circuit, current, cells, and batteries and generators.
- Students will apply the formula for current to electrical circuits.
- Students will generate and apply the equation for Ohm’s Law in electrical circuits.
- Students will define a superconductor and list electrical applications.
- Students will diagram series and parallel circuits.
- Students will define ammeters and voltmeters and analyze their correct positions in an electrical circuit and diagram.
- Students will generate and apply equations for electrical heating in circuits.
- Students will generate and apply equations for electrical work.