KANE AREA SCHOOL DISTRICT

K-12 Science Curriculum

2025

Development and preparation led by Joel Post, K-12 Science Department Chair.

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Kindergarten Science

Statement of Organization:
This course is designed to increase students' knowledge and understanding of Life Science, Physical Science and Earth and Space Science concepts and their skills in unifying scientific themes.

Expected Levels of Achievement:
Students are expected to demonstrate an understanding of science related concepts in guided classroom lessons and tasks.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Demonstrations
- Teacher Observation
- Projects
- Notebooks
- Classroom Discussions

Estimated Instructional Time:
The curriculum listed below consists of the entire period of instruction for the year. Science classes will be conducted for 20 minutes 2 times/week.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
3.1.K.A Life Science: Organization for Matter and Energy Flow in Organisms	How do organisms obtain and use the matter and energy they need to live and grow?	Use observations to describe patterns of what plants and animals (including humans) need to survive.	observation patterns human designed world environment leaves organisms adaptation structure survive	3.1.K.A	Quarter 1
3.2.K.A Physical Science: Forces and Interactions	How can one predict an object's continued motion, changes in motion, or stability?	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	cause and effect explanation motion push pull speed force	3.2.K.A	Quarter 2
3.2.K.B Physical Science: Types of Interactions	What underlying forces explain the variety of interactions observed?	Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and Planning and Carrying Out Investigations With guidance, plan and conduct an investigation in collaboration with peers. Scientists use different ways to study the world.	speed direction collide motion direction collide investigation compare	3.2.K.B	Quarter 2
3.2.K.C Physical Science: Conservation of Energy and Energy Transfer	What is energy?	Make observations to determine the effect of sunlight on Earth's surface	describe earth data sunlight observe cause and effect energy	3.2.K.C	Quarter 2
3.2.K.D Physical Science:	What is energy?	Use tools and materials to design and build a structure that will reduce the warming effect of	solution design	3.2.K.D	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Conservation of Energy and Energy Transfer		sunlight on an area.	tools cause structure cause and effect energy		
3.3.K.A Earth and Space Science: Weather and Climate	What regulates weather and climate?	Use and share observations of local weather conditions to describe patterns over time.	Sunny changes cloudy cold cool foggy hot observe partly cloudy patterns predict rainy snowy warm weather windy	3.3.K.A	Quarter 3
3.3.K.B Earth and Space Science: Biogeology	How do living organisms alter Earth's processes and structures?	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.	Needs environment habitat system survival organisms argument evidence	3.3.K.B	Quarter 3
3.3.K.C Earth and Space Science: Natural Resources	How do Earth's surface processes and human activities affect each other? How do humans depend on Earth's resources?	Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.	argument evidence system model needs	3.3.K.C	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
			habitat survival evidence		
3.3.K.D Earth and Space Science: Natural Hazards	How do natural hazards affect individuals and societies?	Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.	Weather conditions evaluate hazard natural natural hazard process region solution cause and effect	3.3.K.D	Quarter 4
3.3.K.E Earth and Space Science: Human Impact on Earth Systems	How do humans change the planet?	Communicate solutions that will reduce the impact of humans on land, water, air, and/or other living things in the local environment.	recycle reduce reuse communicate cause and effect solutions choice impact land water air	3.3.K.E	Quarter 4

First Grade Science

Statement of Organization:
This course is designed to increase students' knowledge and understanding of Life Science, Physical Science, and Earth/Space Science concepts and their skills in unifying scientific themes.

Expected Levels of Achievement:
Students are expected to master the objectives taught by achieving at least eighty percent (80%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Demonstration
- Teacher observation
- Portfolio
- Projects
- Notebooks
- Teacher-made tests
- Classroom discussions

Estimated Instructional Time:
The curriculum listed below consists of the entire period of instruction for the year. Science in first grade will be conducted for 30 minutes each day for half the school year.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
3.1.1.A Life Science: Structure and Function	How do the structures of organisms enable life's functions?	Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	external mimic problem solution design	3.1.1.A	Quarter 1
3.1.1.B Life Science: Growth and Development of Organisms	How do organisms grow and develop?	Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	behavior observe organisms survive offspring patterns parents	3.1.1.B	Quarter 1
3.1.1.C Life Science: Inheritance of Traits	How are the characteristics of one generation related to the previous generation?	Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	similar offspring observation evidence-based	3.1.1.C	Quarter 1
3.2.1.A Physical Science: Wave Properties	What are the characteristic properties and behaviors of waves?	Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	vibration energy investigation evidence material sound waves	3.2.1.A	Quarter 2
3.2.1.B Physical Science: Electromagnetic Radiation	What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?	Make observations to construct an evidence-based account that objects can be seen only when illuminated.	illuminate light observation evidence-based	3.2.1.B	Quarter 2
3.2.1.C Physical Science: Electromagnetic radiation	What is light? How can one explain the varied effects that involve light? What other forms of	Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.	light beam mirror reflect refract	3.2.1.C	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	electromagnetic radiation are there?		mirror investigation simple test		
3.2.1.D Physical Science: Information Technologies and Instrumentation	How are instruments that transmit and detect waves used to extend human senses?	Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.	communicate distance sound device	3.2.1.D	Quarter 3
3.3.1.A Earth and Space Science: The Universe and It's Stars	We can infer information about stars based on observations we make from Earth.	Use observations of the sun, moon, and stars to describe patterns that can be predicted.	changes describe moon observe patterns predict stars sun	3.3.1.A	Quarter 4
3.3.1.B Earth and Space Science: Earth and the Solar System	What are the predictable patterns caused by Earth's movement in the solar system?	Make observations at different times of year to relate the amount of daylight to the time of year.	predict solar system daylight sky sunrise sunset patterns	3.3.1.B	Quarter 4

Second Grade Science

Statement of Organization:
This course is designed to increase students' knowledge and understanding of Life science, Physical Science, Earth/Space Science, and Earth/Space Science concepts and their skills in unifying scientific themes.

Expected Levels of Achievement:
Students are expected to master the objectives taught by achieving at least eighty percent (80%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Demonstration
- Teacher observation
- Portfolio
- Projects
- Notebooks
- Teacher-made tests
- Classroom discussions

Estimated Instructional Time:
The curriculum listed below consists of the entire period of instruction for the year. Science in second grade will be conducted for 30 minutes each day for half the school year.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
3.1 Life Science: Interdependent relationships in ecosystems	How do organisms interact with living and nonliving environments to obtain matter and energy?	Plan and conduct an investigation to determine if plants need sunlight and water to grow.	environment survive organism species investigation observation needs	3.1.2.A 3.1.2.B	Quarter 1
		Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.	pollinate disperse reproduce model		
3.1 Life Science Biodiversity and Humans	What is biodiversity, how do humans affect it, and how does it affect humans?	Make observations of plants and animals to compare the diversity of life in different habitats.	diversity biodiversity needs organism survive habitat land water	3.1.2.C	Quarter 1
3.2 Physical Science: Structures and properties of matter	How do particles combine to form the variety of matter one observes?	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.	Classify investigate observable properties matter solid liquid gas weight texture describe flexibility patterns	3.2.2.A	Quarter 2
		Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.	boiling cause and effect evidence freezing	3.2.2.B	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
			melting reverse test analyze purpose		
		Make observations to construct an evidence based account of how an object made of a small set of pieces can be disassembled and made into a new object.	construct design reverse engineer assemble disassemble problem solving solutions	3.2.2.C	Quarter 2
3.2 Physical Science: Chemical Reactions	How do substances combine or change (react) to make new substances?	Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot	substance react evidence	3.2.2.D	Quarter 2
3.3 Earth and Space Science: The History of Planet Earth	How do the properties and movements of water shape Earth's surface and affect its systems?	Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	fossils erosion weathering geologic sediment condensation Earth groundwater landscape liquid planet precipitation solid/ice vapor/gas solution	3.3.2.A 3.3.2.B	Quarter 3
3.3 Earth and Space Science: Earth Materials and Systems	How do Earth's major systems interact?	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land			
3.3 Earth and Space Science: Plate Tectonics and Large-Scale System Interactions	Why do continents move, and what causes earthquakes and volcanoes?	Develop a model to represent the shapes and kinds of land and bodies of water in an area.	landform (multiple examples) model patterns	3.3.2.c	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
			maps continents earthquakes bodies of water		
3.3 Earth and Space Science: The Roles of Water in Earth's Surface Processes	How do the properties and movements of water shape Earth's surface and affect its systems?	Obtain information to identify where water is found on Earth and that it can be solid or liquid	water cycle evaporation transpiration condensation infiltration patterns scientific question	3.3.2.D	Quarter 4

K-2 Environmental Literacy and Sustainability

Statement of Organization:
This course is designed to increase students' knowledge of Environmental Literacy, Agricultural and Environmental Systems and Resources, and Sustainability and Stewardship.

Expected Levels of Achievement:
Students are expected to master the objectives taught by achieving at least eighty percent (80%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Demonstration
- Teacher observation
- Portfolio
- Projects
- Notebooks
- Teacher-made tests
- Classroom discussions

Estimated Instructional Time:
The curriculum listed below may take up to three weeks of instruction. This curriculum may overlap with the social studies curriculum.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
3.4 K-2.A Environmental Literacy: Investigating Environmental Issues	How do living things utilize natural resources in ways that impact agricultural and environmental systems? How do agricultural systems interact with environmental systems?	Categorize ways people harvest, re-distribute, and use natural resources.	wood, fruit, wool, garden, compost, energy, fiber, harvest, natural resources, recycle, reuse, reuse, transportation, food-fiber system, agriculture, farm, orchard	3.4 K-2.A	3 weeks
3.4 K-2.B Agricultural and Environmental Systems and Resources: Environment and Society	How do human cultures and societies experience, interact, and value local, regional, and/or global environments? How do various human cultures express their beliefs about nature and the environment? How are natural resources managed by people from various cultures and communities?	Examine how people from different cultures and communities, including one's own, interact and express their beliefs about nature.	pattern, consumer, local, global, stability, change, environment, community, cause and effect, consequence, natural resources, habitat	3.4.K-2.B	3 weeks
3.4 K-2.D Environmental Literacy Skills: Environmental Experiences	How can conducting local field investigations lead to identifying, understanding, and addressing environmental issues in my community?	Plan and carry out an investigation to address an issue in the local environment and community.	observe, measure, difference, similar, changes, balance	3.4.K-2.D	3 weeks
3.4 K-2.C Sustainability and Stewardship: Environmental Sustainability	How do actions and regulations support the equitable availability of resources for current and future generations?	Explain ways that places differ in their physical characteristics, their meaning, and their value and/or importance.	evidence, values, empathy, observation, physical characteristics, law, resources, compassion	3.4.K-2.C	3 weeks

K-2 Technology and Engineering

Statement of Organization:
This course is designed to increase students' knowledge of Technology and Engineering.

Expected Levels of Achievement:
Students are expected to demonstrate an understanding of science related concepts in guided classroom lessons and tasks.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Demonstrations
- Teacher Observation
- Projects
- Notebooks
- Classroom Discussions

Estimated Instructional Time: The curriculum listed below consists of the entire period of instruction for the year. Science classes will be conducted for 30 minutes over half of the school year.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Anticipated Pacing
3.5.K-2.BB Technology and Engineering Nature and Characteristics of Technology and Engineering	Why is it important to have an understanding of the natural and human-made worlds?	Compare the natural world and the human-made world.	natural world human-made compare	3.5.K-2.BB	Quarter 1
3.5.K-2.CC Technology and Engineering Nature and Characteristics of Technology and Engineering	How does the interdisciplinary nature of technology and engineering influence human activity?	Discuss the roles of scientists, engineers, technologists and others who work with technology.	scientist engineer technologist technology interdisciplinary	3.5.K-2.CC	Quarter 1
3.5.K-2.AA Technology and Engineering Nature and Characteristics of Technology and Engineering	Why is it important to understand, use, assess, and create technological products, systems, and ways of thinking?	Demonstrate that creating can be done by anyone.	technology engineering technological products technological systems tools techniques	3.5.K-2.AA	Quarter 1
3.5.K-2.DD Technology and Engineering Nature and Characteristics of Technology and Engineering	How are various resources used in technology and engineering activities?	Collaborate effectively as a member of a team.	collaborate team	3.5.K-2.DD	Quarter 2
3.5.K-2.Z Technology and Engineering Nature and Characteristics of Technology and Engineering	How do system components work together to achieve a desired goal?	Illustrate how systems have parts or components that work together to accomplish a goa	Illustrate system part goal	3.5.K-2.Z	Quarter 2
3.5.K-2.Y Technology and	How do technological advancements define different	Discuss how the way people live and work has changed throughout	discuss communicate	3.5.K-2.Y	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Anticipated Pacing
Engineering Nature and Characteristics of Technology and Engineering	historical eras?	history because of technology.	tool process		
3.5.K-2.I Technology and Engineering Nature and Characteristics of Technology and Engineering	How do technological advancements define different historical eras?	Compare simple technologies to evaluate their impacts.	compare evaluate impact	3.5.K-2.I	Quarter 2
3.5.K-2.R Technology and Engineering: Integration of Knowledge, Technologies, and Practices	How does technology and engineering relate to other content areas?	Draw connections between technology and human experiences.	connections technology	3.5.K-2.R	Quarter 3
3.5.K-2.W Technology and Engineering: Integration of Knowledge, Technologies, and Practices	How does technology and engineering relate to other content areas?	Apply concepts and skills from technology and engineering activities that reinforce concepts and skills across multiple areas.	apply discipline	3.5.K-2.W	Quarter 3
3.5.K-2.V Technology and Engineering: Integration of Knowledge, Technologies, and Practices	How do advancements from one field impact another?	Explain that materials are selected for use because they possess desirable properties and characteristics.	property characteristic plan task	3.5.K-2.V	Quarter 3
3.5.K-2.X Technology and Engineering: Integration of Knowledge, Technologies, and Practices	How do advancements from one field impact another?	Develop a plan in order to complete a task.	task plan	3.5.K-2.X	Quarter 3
3.5.K-2.O Technology & Engineering: Design in Technology &	Why is there no single correct solution in design?	Illustrate that there are different solutions to a design and that none are	illustrate solution design	3.5.K-2.O	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Anticipated Pacing
Engineering Education		perfect.	want need plausible		
3.5.K-2.U Technology & Engineering: Design in Technology & Engineering Education	Why is there no single correct solution in design?	Explain that design is a response to wants and needs.	need want	3.5.K-2.U	Quarter 4
3.5.K-2.N Technology & Engineering: Design in Technology & Engineering Education	What is the value of iteration within the design process?	Analyze how things work.	analyze deconstruction construction	3.5.K-2.N	Quarter 4
3.5.K-2.M Technology & Engineering: Design in Technology & Engineering Education	How are requisite skills applied in technology and engineering design?	Demonstrate essential skills of the engineering design process.	demonstrate essential skills necessary design	3.5.K-2.M	Quarter 4
3.5.K-2.Q Technology & Engineering: Design in Technology & Engineering Education	How are requisite skills applied in technology and engineering design?	Apply skills necessary for making in design.	design	3.5.K-2.Q	Quarter 4
3.5.K-2.P Technology & Engineering: Design in Technology & Engineering Education	How are designs influenced by universal principles and elements of design?	Discuss that all designs have different characteristics that can be described.	characteristic describe	3.5.K-2.P	Quarter 4
3.5.K-2.S Technology & Engineering: Design in Technology & Engineering Education	How do criteria and constraints drive design?	Apply design concepts, principles, and processes through play and exploration.	apply explore requirements	3.5.K-2.S	Quarter 4
3.5.K-2.S Technology & Engineering: Design in Technology & Engineering Education	How do criteria and constraints drive design?	Demonstrate that designs have requirements.	requirements	3.5.K-2.S	Quarter 4

Third Grade Science

Statement of Organization:
This course is designed for students who have successfully completed the second-grade science course. Students will show growth in the branches of science including the following: Life Science, Physical, Earth/Space, and Environmental Literacy and Sustainability and Technology and Engineering.

Expected Levels of Achievement:
Students are expected to master the objectives taught by achieving at least seventy-seven percent (77%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- drill and practice
- demonstration
- teacher observation
- journals/portfolios
- projects/labs
- standardized tests
- teacher-made tests
- oral presentations
- classroom discussion
- benchmark assessments
- computer based testing
- developing and using models
- constructing arguments
- planning and conducting investigations

Estimated Instructional Time:
1 school year (30 minutes per day for 3 quarters)

Sequence
Earth Science, Physical Science, Structures of Life

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with the standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Earth and Space Science: Weather and Climate	What regulates weather and climate?	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. Obtain and combine information to describe climates in different regions of the world.	weather season climate patterns graphical displays data conditions regions	3.3.3.A 3.3.3.B	Quarter 1
Earth and Space Science: Natural Hazards	How do natural hazards affect individuals and societies?	Make a claim supported by evidence about the merit of a design solution that reduces the impacts of a weather-related hazard.	natural hazard atmosphere impact data weather constraints	3.3.3.C	Quarter 1
Environmental Literacy & Sustainability: Watershed and Wetlands	How do watersheds and wetlands function as interconnected systems that support, impact, and are influenced by living things? How do human actions impact the functions of watersheds and wetlands?	Examine ways you influence your local environment and community by collecting and displaying data.	Best Management Practices contour consequences pollution discharge buffers runoff waste Storm Drains stormwater management up/downstream water cycle nutrient cycle watershed wetlands corridor	3.4.3-5.C	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Environmental Literacy & Sustainability: Investigating Environmental Issues	How do investigations of local environmental issues expand understanding and facilitate potential solutions to other local, regional, and/or global environmental issues?	Develop a model to demonstrate how local environmental issues are connected to larger local environment and human systems.	urban heat island indicator index food access, insecurity acid mine drainage remediation mitigation	3.4.3-5.D	Quarter 1
Technology and Engineering: Applying, Maintaining, and Assessing Technological Products and Systems	Why is it important for people to be technologically literate? How can a product, system, or process be kept in proper working order? How can information be used to evaluate technological products, systems and processes? Why is it important to sustainably manage technological resources? How does technology and engineering address the needs and wants of society? How do the values and beliefs of societies shape attitudes toward technology? How does changing technology impact the	Design solutions by safely using tools, materials, and skills. Demonstrate how tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing. Examine information to assess the trade-offs to using a product or system. Describe the helpful and harmful effects of technology. Explain why responsible use of technology requires sustainable management of resources. Classify resources used to create technologies as either renewable or nonrenewable. Predict how certain aspects of their daily lives would be different without given technologies.	tool material skill resource capability machine gather synthesize draw conclusion helpful harmful effect technology sustainable sustainability renewable nonrenewable waste classify renewable nonrenewable predict need want change develop adapt Judge	3.5.3-5.J 3.5.3-5.L 3.5.3-5.B 3.5.3-5.G 3.5.3-5.E 3.5.3-5.F 3.5.3-5.D 3.5.3-5.J 3.5.3-5.K 3.5.3-5.H	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	individual, culture, and environment?	Explain how technologies are developed or adapted when individual or societal needs and wants change. Judge technologies to determine the best one to use to complete a given task or meet a need. Determine factors that influence changes in a society's technological systems or infrastructure.	culture environment individual change infrastructure		
Technology and Engineering: Integration of Knowledge, Technologies, and Practices	How does technology and engineering relate to other content areas? How do advancements from one field impact another?	Explain how various relationships can exist between technology and engineering and other content areas. Describe the properties of different materials. Identify the resources needed to get a technical job done, such as people, materials, capital, tools, machines, knowledge, energy, and time. Create a new product that improves someone's life.	relationship content exist discipline property application material capital resource improve invention innovation	3.5.3-5.X 3.5.3-5.W 3.5.3-5.Y 3.5.3-5.Z	Quarter 1
Technology and Engineering: Design in Technology & Engineering Education	Why is there no single correct solution in design? What is the value of iteration within the design process? How are requisite skills applied in technology and engineering design?	Interpret how good design improves the human condition. Illustrate that there are multiple approaches to design Identify why a product or system is not working properly.	design system iteration troubleshooting solution constraint limitation criteria optimization	3.5.3-5.V 3.5.3-5.S 3.5.3-5.N 3.5.3-5.M 3.5.3-5.Q 3.5.3-5.R 3.5.3-5.P 3.5.3-5.O 3.5.3-5.T	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	How are designs influenced by universal principles and elements of design? How do criteria and constraints drive design?	Demonstrate essential skills of the engineering design process. Practice successful design skills. Apply tools, techniques, and materials in a safe manner as part of the design process. Evaluate the strengths and weaknesses of existing design solutions, including their own solutions. Describe requirements of designing or making a product or system. Apply universal principles and elements of design. Evaluate designs based on criteria, constraints, and standards.		3.5.3-5.U	
Physical Science: Forces and Motion	How can one predict an object's continued motion, changes in motion, or stability? How can one predict an object's continued motion, changes in motion, or stability?	Make and communicate observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	motion pattern balanced forces unbalanced forces prediction observation cause and effect	3.2.3.A 3.2.3.B	Quarter 2
Physical Science: Types of Interactions	What underlying forces explain the variety of interactions observed? What underlying forces	Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	electric interactions magnetic interactions orientation design	3.2.3C 3.2.3D	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	explain the variety of interactions observed?	Define a simple design problem that can be solved by applying scientific ideas about magnets.	magnetic forces forces interaction solution		
Life Science: Growth and Development of Organisms	How do the structures of organisms enable life's functions?	Develop models to describe that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death.	organisms diverse life cycles reproduction unique	3.1.3.A	Quarter 3
Life Science: Social Interactions and Group Behavior	How do organisms interact in groups to benefit individuals?	Construct an argument that some animals form groups that help members survive.	organisms interdependence cause and effect argument evidence	3.1.3.B	Quarter 3
Life Science: Inheritance of Traits	How are the characteristics of one generation related to the previous generation?	Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation	inherited variations evidence patterns	3.1.3.C	Quarter 3
Life Science: Variation of Traits	Why do individuals of the same species vary in how they look, function, and behave?	Use evidence to support the explanation that traits can be influenced by the environment.	traits inheritance evidence variation cause and effect	3.1.3.D	Quarter 3
Life Science: Evidence of Common Ancestry and Diversity	What evidence shows that different species are related?	Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.	fossils organisms environments evidence scale extinction	3.1.3.E	Quarter 3
Life Science: Natural Selection	How does genetic variation among organisms affect survival and reproduction?	Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages	variation species reproduce adaptation	3.1.3.F	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		in surviving, finding mates, and reproducing.	reproduce variation characteristics advantage cause and effect natural selection		
Life Science: Adaptation	How does the environment influence populations of organisms over multiple generations?	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.	habitat survival organisms cause and effect adaptation	3.1.3.G	Quarter 3
Life Science: Biodiversity and Humans	What is biodiversity, how do humans affect it, and how does it affect humans?	Make a claim supported by evidence about the merit of a solution to a problem caused when the environment changes the types of plants and animals that live there may change.	system biodiversity changes evidence climate change environment	3.1.3.H	Quarter 3
Environmental Literacy & Sustainability: Agricultural Systems	How do living things utilize natural resources in ways that impact agricultural and environmental systems? How do agricultural systems interact with environmental systems?	Analyze how living organisms, including humans, affect the environment in which they live, and how their environment affects them.	Adaptation Ecosystem Biomes producer consumer decomposer food chain/web harvest waste chain renewable nonrenewable pollinators predator or/prey erosion dependence drought	3.4 3-5.A	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Environmental Literacy & Sustainability: Environment and Society	How do human cultures and societies experience, interact, and value local, regional, and/or global environments? How do various human cultures express their beliefs about nature and the environment? How are natural resources managed by people from various cultures and communities?	Make a claim about the environmental and social impacts of design solutions and civic actions, including their own actions.	Habitat Impacts biodiversity population organisms consequences waste disposal riparian zone buffering capacity wildlife corridor Best Management Practices consumer recycle land use treatment	3.4.3-5.B	Quarter 3
Environmental Literacy & Sustainability: Evaluating Experiences	How do we balance societal values, practices, and cost-benefit analysis (long-term and short-term) in addressing environmental issues?	Construct an argument to support whether action is needed on a selected environmental issue and propose possible solutions.	Pest Pesticide insecticide herbicide food chain food web native species non-native species values	3.4.3-5.E	Quarter 3
Environmental Literacy & Sustainability: Environmental Stewardship	How can human actions improve environmental quality, sustainability, and community well-being?	Critique ways that people depend on and change the environment.	advocate ownership responsibly stewardship conservation recreation access share	3.4.3-5.F	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Environmental Literacy & Sustainability: Environmental Justice	How do human actions impact environmental justice issues for individuals and communities? How do human actions impact on the equitable access, use, and disposal of natural resources?	Investigate how perspectives over the use of resources and the development of technology has changed over time and resulted in conflict over the development of societies and nations.	Equal Sharing access differences opinions facts	3.4.3-5.G	Quarter 3
Technology & Engineering: Nature and Characteristics of Technology and Engineering	Why is it important to have an understanding of the natural and human-made worlds? How does the interdisciplinary nature of technology and engineering influence human activity? How do system components work together to achieve a desired goal?	Compare how things are found in nature differs from things that are human made, noting differences and similarities in how they are produced and used. Describe the unique relationship between science and technology, and how the natural world can contribute to the human-made world to foster innovation. Differentiate between the role of scientists, engineers, technologists, and others in creating and maintaining technological systems. Explain how solutions to problems are shaped by economic, political, and cultural forces Illustrate how, when parts	natural world human-made world resource innovation energy science technology contribute technologist engineer interdisciplinary influence system solution financial resource cultural political system part component	3.5.3-5.FF 3.5.3.5 GG 3.5.3-5.HH 3.5.3.5 EE 3.5.3-5.BB	Quarters 1,2,3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		of a system are missing, it may not work as planned. Describe how a subsystem is a system that operates as a part of another larger system.			
Technology and Engineering: Nature and Characteristics of Technology and Engineering	Why is it important to have an understanding of the natural and human-made worlds? How does the interdisciplinary nature of technology and engineering influence human activity? How do system components work together to achieve a desired goal? How do technological advancements define different historical eras?	Compare how things found in nature differ from things that are human-made, noting differences and similarities in how they are produced and used. Describe the unique relationship between science and technology, and how the natural world can contribute to the human-made world to foster innovation. Differentiate between the role of scientists, engineers, technologists, and others in creating and maintaining technological systems. Explain how solutions to problems are shaped by economic, political, and cultural forces. Illustrate how, when parts of a system are missing, it may not work as planned. Describe how a subsystem is a system that operates as a part of another larger system.	natural world human-made world resource innovation energy science technology contribute technologist engineer interdisciplinary influence system solution financial resource cultural political system part component subsystem system distribution technology system construct escalator	3.5.3-5.FF 3.5.3-5.GG 3.5.3-5.HH 3.5.3-5.EE 3.5.3-5.BB 3.5.3-5.CC 3.5.3-5.DD 3.5.3-5.AA 3.5.3-5.K	Quarters 1,2,3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		Demonstrate how simple technologies are often combined to form more complex systems. Create representations of the tools people made, how they cultivated to provide food, made clothing, and built shelters to protect themselves. Judge technologies to determine the best one to use to complete a given task or meet a need.	tool shelter product variation historical era		

Fourth Grade Science

Statement of Organization:
This course is designed for students who have successfully completed the third-grade science course. Students will show growth in the branches of science including the following: Life Science, Physical, Earth/Space, and Environmental Literacy and Sustainability.

Expected Levels of Achievement:
Students are expected to are to master the objectives taught by achieving at least seventy-seven percent (77%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:
Student competence will be assessed through the use of one or more of the following methods:

- drill and practice
- demonstration
- teacher observation
- portfolios
- projects/labs
- standardized tests
- teacher-made tests
- oral presentations
- classroom discussion
- Benchmark assessments
- Computer based testing

Estimated Instructional Time:
1 school year

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with the standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Physical Science: Definition of Energy	What is energy?	Use evidence to construct an explanation relating the speed of an object to the energy of that object.	evidence speed energy	3.2.4.A	1st quarter
Physical Science: Conservation of Energy and Energy Transfer	What is meant by conservation of energy? How is energy transferred between objects or systems?	Make and communicate observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	observations energy transformation transferred sound energy light energy heat energy electric currents patterns	3.2.4.B	1st quarter
Physical Science: Relationship Between Energy and Forces	How are forces related to energy?	Ask questions and predict outcomes about the changes in energy that occur when objects collide.	change of energy energy transformation collision solve design problems	3.2.4.C	1st quarter
Physical Science: Energy in Chemical Processes and Everyday Life	How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	conserved produced refine convert current energy transformation design problems	3.2.4.D	1st quarter
Physical Science: Wave Properties	What are the characteristic properties and behaviors of waves?	Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	waves amplitude wavelength waves model patterns scientific principle	3.2.4.E	1st Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Physical Science: Electromagnetic Radiation	What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?	Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	reflect light cause and effect	3.2.4.F	1st Quarter
Physical Science: Information Technologies and Instrumentation	How are instruments that transmit and detect waves used to extend human senses?	Generate and compare multiple solutions that use patterns to transfer information.	patterns transfer technology instrument multiple solutions	3.2.4.G	1st Quarter
Earth and Space Science: The History of Planet Earth	How do people reconstruct and date events in Earth's planetary history?	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.	rock formations sedimentation weathering evidence fossil types rock layers landscape patterns	3.3.4.A	2nd Quarter
Earth and Space Science: Earth Materials and Systems	How and why is Earth constantly changing?	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	weathering erosion vegetation cause and effect phenomenon	3.3.4.B	2nd Quarter
Earth and Space Science: Plate Tectonics and Large-Scale System Interactions	Why do the continents move, and what causes earthquakes and volcanoes?	Analyze and interpret data from maps to describe patterns of Earth's features.	data earth's features patterns maps	3.3.4.C	2nd Quarter
Earth and Space Science: Natural Resources	How do Earth's surface processes and human activities affect each other?	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	energy fuels natural resources renewable resources nonrenewable	3.3.4.D	2nd Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	How do humans depend on Earth's resources?		resources alternate energy hydropower geothermal biomass solar power environment		
Earth and Space Science: Natural Hazards	How do natural hazards affect individuals and societies?	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	solutions reduce impacts earth processes natural hazard earth processes cause and effect design solution constraints	3.3.4.E	2nd Quarter
Life Science: Structure and Function	How do the structures of organisms enable life's functions?	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	internal structures external structures system argument model evidence behavior reproduction	3.1.4.A	3rd Quarter
Life Science: Information Processing	How do organisms detect, process, and use information about the environment?	Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.	senses processes model system sense receptors information perceptions	3.1.4.B	3rd Quarter
Environmental Literacy and Sustainability: Agricultural Systems	How do living things utilize natural resources in ways that impact agricultural and environmental systems?	Analyze how living organisms, including humans, affect the environment in which they live, and how their environment affects them.	adaptation ecosystem biomes producer	3.4 3-5.A	3rd Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	How do agricultural systems interact with environmental systems?		consumer decomposer food chain/web harvest waste chain renewable nonrenewable pollinators predator or/prey erosion dependence drought		
Environmental Literacy and Sustainability: Environment and Society	How do human cultures and societies experience, interact, and value local, regional, and/or global environments? How do various human cultures express their beliefs about nature and the environment? How are natural resources managed by people from various cultures and communities?	Make a claim about the environmental and social impacts of design solutions and civic actions, including their own actions.	habitat impacts biodiversity population organism consequences waste disposal riparian zone buffering capacity wildlife corridor best management practices consumer recycle land use treatment	3.4.3-5.B	3rd Quarter
Environmental Literacy and Sustainability: Watersheds and Wetlands	How do watersheds and wetlands function as interconnected systems that support, impact, and are influenced by living things?	Examine ways you influence your local environment and community by collecting and displaying data.	best management practices contour consequences pollution discharge	3.4.3-5.C	3rd Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	How do human actions impact the functions of watersheds and wetlands?		buffers runoff waste storm drains stormwater management up/downstream water cycle nutrient cycle watershed wetlands corridor		
Environmental Literacy and Sustainability: Investigating Environmental Issues	How do investigations of local environmental issues expand understanding and facilitate potential solutions to other local, regional, and/or global environmental issues?	Develop a model to demonstrate how local environmental issues are connected to larger local environment and human systems.	urban heat island indicator index food access insecurity acid mine drainage remediation mitigation	3.4.3-5.D	3rd Quarter
Environmental Literacy and Sustainability: Evaluating Experiences	How do we balance societal values, practices, and cost-benefit analysis (long-term and short-term) in addressing environmental issues?	Construct an argument to support whether action is needed on a selected environmental issue and propose possible solutions.	pest pesticide insecticide herbicide food chain food web native species non-native species values	3.4.3-5.E	3rd Quarter
Environmental Literacy and Sustainability: Environmental Stewardship	How can human actions improve environmental quality, sustainability, and community well-being?	Critique ways that people depend on and change the environment.	advocate ownership responsibly stewardship conservation recreation access share	3.4.3-5.F	3rd Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Environmental Literacy and Sustainability: Environmental Justice	How do human actions impact environmental justice issues for individuals and communities? How do human actions impact the equitable access, use, and disposal of natural resources?	Investigate how perspectives over the use of resources and the development of technology have changed over time and resulted in conflict over the development of societies and nations.	equal sharing access differences opinions facts	3.4.3-5.G	3rd Quarter
Technology and Engineering: Nature and Characteristics of Technology and Engineering	Why is it important to have an understanding of the natural and human-made worlds? How does the interdisciplinary nature of technology and engineering influence human activity? How do system components work together to achieve a desired goal? How do technological advancements define different historical eras?	Compare how things found in nature differ from things that are human-made, noting differences and similarities in how they are produced and used. Describe the unique relationship between science and technology, and how the natural world can contribute to the human-made world to foster innovation. Differentiate between the role of scientists, engineers, technologists, and others in creating and maintaining technological systems. Explain how solutions to problems are shaped by economic, political, and cultural forces. Illustrate how, when parts of a system are missing, it may not work as planned. Describe how a subsystem is a system that operates as a part of another larger	natural world human-made world resource innovation energy science technology contribute technologist engineer interdisciplinary influence system solution financial resource cultural political system part component subsystem system distribution technology system	3.5.3-5.FF 3.5.3-5.GG 3.5.3-5.HH 3.5.3-5.EE 3.5.3-5.BB 3.5.3-5.CC 3.5.3-5.DD 3.5.3-5.AA 3.5.3-5.K	4th Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		system. Demonstrate how simple technologies are often combined to form more complex systems. Create representations of the tools people made, how they cultivated to provide food, made clothing, and built shelters to protect themselves. Judge technologies to determine the best one to use to complete a given task or meet a need.	construct escalator tool shelter product variation historical era		
Technology and Engineering: Applying, Maintaining, and Assessing Technological Products and Systems	Why is it important for people to be technologically literate? How can a product, system, or process be kept in proper working order? How can information be used to evaluate technological products, systems and processes? Why is it important to sustainably manage technological resources? How does technology and engineering address the needs and wants of society?	Design solutions by safely using tools, materials, and skills. Demonstrate how tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing. Examine information to assess the trade-offs to using a product or system. Describe the helpful and harmful effects of technology. Explain why responsible use of technology requires sustainable management of resources. Classify resources used to create technologies as either renewable or nonrenewable.	tool material skill resource capability machine gather synthesize draw conclusion helpful harmful effect technology sustainable sustainability renewable nonrenewable waste classify renewable nonrenewable predict	3.5.3-5.J 3.5.3-5.L 3.5.3-5.B 3.5.3-5.G 3.5.3-5.E 3.5.3-5.F 3.5.3-5.D 3.5.3-5.J 3.5.3-5.K 3.5.3-5.H	4th Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	How do the values and beliefs of societies shape attitudes toward technology? How does changing technology impact the individual, culture, and environment?	Predict how certain aspects of their daily lives would be different without given technologies. Explain how technologies are developed or adapted when individual or societal needs and wants change. Judge technologies to determine the best one to use to complete a given task or meet a need. Determine factors that influence changes in a society's technological systems or infrastructure.	need want change develop adapt judge culture environment individual change infrastructure		
Technology and Engineering: Integration of Knowledge, Technologies, and Practices	How does technology and engineering relate to other content areas? How do advancements from one field impact another?	Explain how various relationships can exist between technology and engineering and other content areas. Describe the properties of different materials. Identify the resources needed to get a technical job done, such as people, materials, capital, tools, machines, knowledge, energy, and time. Create a new product that improves someone's life.	relationship content exist discipline property application material capital resource improve invention innovation	3.5.3-5.X 3.5.3-5.W 3.5.3-5.Y 3.5.3-5.Z	4th Quarter
Technology and Engineering: Design in Technology & Engineering Education	Why is there no single correct solution in design? What is the value of iteration within the design process?	Interpret how good design improves the human condition. Illustrate that there are multiple approaches to design	system iteration troubleshooting solution constraint limitation	3.5.3-5.V 3.5.3-5.S 3.5.3-5.N 3.5.3-5.M 3.5.3-5.Q 3.5.3-5.R	4th Quarter

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	How are requisite skills applied in technology and engineering design? How are designs influenced by universal principles and elements of design? How do criteria and constraints drive design?	Identify why a product or system is not working properly. Demonstrate essential skills of the engineering design process. Practice successful design skills. Apply tools, techniques, and materials in a safe manner as part of the design process. Evaluate the strengths and weaknesses of existing design solutions, including their own solutions. Describe requirements of designing or making a product or system. Apply universal principles and elements of design. Evaluate designs based on criteria, constraints, and standards.	solution constraint limitation solution constraint limitation criteria optimization	3.5.3-5.P 3.5.3-5.O 3.5.3-5.T 3.5.3-5.U	

Fifth Grade Science

Statement of Organization:
This course is designed for students who have successfully completed the fourth-grade science course. Students will show growth in the branches of science including the following: Life Science, Physical, Earth/Space, Environmental Literacy and Sustainability, and Technology and Engineering.

Expected Levels of Achievement:
All students are expected to master the objectives taught by achieving at least eighty percent (77%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- drill and practice
- demonstration
- teacher observation
- portfolios
- projects
- standardized tests
- teacher-made tests
- oral presentations
- classroom discussion
- Benchmark assessments
- Computer based testing

Estimated Instructional Time:
30 minutes per day (1 school year)

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with the standards.

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
Life Science: Organization for Matter and Energy Flow in Organisms	How do organisms detect, process, and use information about the environment?	Support an argument that plants get the materials they need for growth chiefly from air and water	argument evidence materials systems matter	3.1.5.A	Quarter 1
Life Science: Interdependent Relationships in Ecosystems	How do organisms interact with the living and nonliving environments to obtain matter and energy?	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	living non-living decomposers decomposition biotic abiotic food web consumer producer energy systems components	3.1.5.B	Quarter 1
Environmental Literacy & Sustainability: Agricultural Systems	How do living things utilize natural resources in ways that impact agricultural and environmental systems? How do agricultural systems interact with environmental systems?	Analyze how living organisms, including humans, affect the environment in which they live, and how their environment affects them.	adaptation ecosystem biomes producer consumer decomposer food chain/web, harvest waste chain renewable nonrenewable pollinators predator or/prey erosion dependence drought	3.4 3-5.A	Quarter 1
Environmental Literacy & Sustainability:	How do human cultures and societies experience,	Make a claim about the environmental and social impacts of design solutions	Habitat impacts	3.4.3-5.B	Quarter 1

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
Environment and Society	interact, and value local, regional, and/or global environments? How do various human cultures express their beliefs about nature and the environment? How are natural resources managed by people from various cultures and communities?	and civic actions, including their own actions.	biodiversity population organism consequences waste disposal riparian zone buffering capacity wildlife corridor best management practices consumer recycle land use treatment		
Environmental Literacy & Sustainability: Watersheds and Wetlands	How do watersheds and wetlands function as interconnected systems that support, impact, and are influenced by living things? How do human actions impact the functions of watersheds and wetlands?	Examine ways you influence your local environment and community by collecting and displaying data.	best management practices contour consequences pollution discharge buffers runoff waste storm drains stormwater management up/downstream water cycle, nutrient cycle watershed wetlands corridor	3.4.3-5.C	Quarter 1
Environmental Literacy & Sustainability: Investigating	How do investigations of local environmental issues expand understanding and	Develop a model to demonstrate how local environmental issues are connected to larger local environment	urban heat island, indicator index food access	3.4.3-5.D	Quarter 1

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
Environmental Issues	facilitate potential solutions to other local, regional, and/or global environmental issues?	and human systems	insecurity acid mine drainage remediation mitigation		
Environmental Literacy & Sustainability: Evaluating Experiences	How do we balance societal values, practices, and cost-benefit analysis (long-term and short-term) in addressing environmental issues?	Construct an argument to support whether action is needed on a selected environmental issue and propose possible solutions.	pest pesticide insecticide herbicide food chain food web native species non-native species values	3.4.3-5.E	Quarter 1
Environmental Literacy & Sustainability: Environmental Stewardship	How can human actions improve environmental quality, sustainability, and community well-being?	Critique ways that people depend on and change the environment.	Advocate Ownership Responsibly Stewardship Conservation Recreation Access share	3.4.3-5.F	Quarter 1
Physical Science: Structure and Properties of Matter	How do particles combine to form the variety of matter one observes? How do particles combine to form the variety of matter one observes?	Develop a model to describe matter is made of particles too small to be seen. Make and communicate observations and measurements to identify materials based on their properties. Interpret and analyze data to make	Particles Matter properties gases scale models standard units measurements properties materials observations model characteristics properties matter	3.2.5.A 3.2.5.B 3.2.5.C	Quarter 2

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
	How do particles combine to form the variety of matter one observes?	decisions about how to utilize materials based on their properties	standard units		
Physical Science: Chemical Reactions	How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them? How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?	Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. Investigate to determine whether the mixing of two or more substances results in new substances.	hardness mass Moh's scale porosity properties solubility volume scale standard units cause and effect substance reactions chemical reaction predictions properties react trials	3.2.5.D 3.2.5.E	Quarter 2
Physical Science: Types of Interactions	What underlying forces explain the variety of interactions observed?	Support an argument that the gravitational force exerted by Earth on objects is directed down.	gravitational force cause and effect model	3.2.5.F	Quarter 2
Physical Science: Energy in Chemical Processes and Everyday Life	How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	energy flow model chemical process model matter conserved	3.2.5.G	Quarter 2
Earth and Space Science: The Universe and Its Stars	What is the universe, and what is Earth's place in it?	Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.	apparent brightness relative distance stars sun	3.3.5.A	Quarter 3

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
Earth and Space Science: Earth and the Solar System	What are the predictable patterns caused by Earth's movement in the solar system?	Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	data graphical display patterns representation shadows	3.3.5.B	Quarter 3
Earth and Space Science: Plate Tectonics and Large - Scale System Interactions	Why do the continents move, and what causes earthquakes and volcanoes?	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	atmosphere biosphere chemical change geosphere hydrosphere model system model scientific principle	3.3.5.C	Quarter 3
Earth and Space Science: The Roles of Water in Earth's Surface Processes	What regulates weather and climate?	Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.	distribution reservoir fresh water weight volume scientific question proportion weather climate	3.3.5.D	Quarter 3
Earth and Space Science: Human Impact on Earth Systems	How do humans change the planet? How do humans change the planet?	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. Generate and design possible solutions to a current environmental issue, threat, or concern.	Atmosphere human impact systems resources environmental issue design solution design process empirical evidence conservationist	3.3.5.E 3.3.5.F	Quarter 3
Environmental Literacy & Sustainability: Environmental Justice	How do human actions impact environmental justice issues for individuals and communities?	Investigate how perspectives over the use of resources and the development of technology have changed over time and resulted in conflict over the	Equal Sharing Access Differences	3.4.3-5.G	Quarter 1,2,3

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
	How do human actions impact the equitable access, use, and disposal of natural resources?	development of societies and nations.	Opinions facts		
Technology and Engineering: Nature and Characteristics of Technology and Engineering	Why is it important to understand the natural and human-made worlds? How does the interdisciplinary nature of technology and engineering influence human activity? How do system components work together to achieve a desired goal? How do technological advancements define different historical eras?	Compare how things found in nature differ from things that are human made, noting differences and similarities in how they are produced and used. Describe the unique relationship between science and technology, and how the natural world can contribute to the human-made world to foster innovation. Differentiate between the role of scientists, engineers, technologists, and others in creating and maintaining technological systems. Explain how solutions to problems are shaped by economic, political, and cultural forces. Illustrate how, when parts of a system are missing, it may not work as planned. Describe how a subsystem is a system that operates as a part of another larger system. Demonstrate how simple technologies are often combined to form more complex systems.	natural world human-made world resource innovation energy science technology contribute technologist engineer interdisciplinary influence system solution financial resource cultural political system part component subsystem system distribution technology system construct escalator tool shelter product	3.5.3-5.FF 3.5.3-5.GG 3.5.3-5.HH 3.5.3-5.EE 3.5.3-5.BB 3.5.3-5.CC 3.5.3-5.DD 3.5.3-5.AA	Quarter 1,2,3

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
		Create representations of the tools people made, how they cultivated to provide food, made clothing, and built shelters to protect themselves. Judge technologies to determine the best one to use to complete a given task or meet a need.	variation historical era		
Technology and Engineering: Applying, Maintaining, and Assessing Technological Products and Systems	Why is it important for people to be technologically literate? How can a product, system, or process be kept in proper working order? How can information be used to evaluate technological products, systems and processes? Why is it important to sustainably manage technological resources? How does technology and engineering address the needs and wants of society? How do the values and beliefs of societies shape attitudes toward technology?	Design solutions by safely using tools, materials, and skills. Demonstrate how tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing. Examine information to assess the trade-offs to using a product or system. Describe the helpful and harmful effects of technology. Explain why responsible use of technology requires sustainable management of resources. Classify resources used to create technologies as either renewable or nonrenewable. Predict how certain aspects of their daily lives would be different without given technologies. Explain how technologies are	tool material skill resource capability machine gather synthesize draw conclusion helpful harmful effect technology sustainable sustainability renewable nonrenewable waste classify renewable nonrenewable predict need want change develop adapt judge (verb)	3.5.3-5.I 3.5.3-5.L 3.5.3-5.B 3.5.3-5.G 3.5.3-5.E 3.5.3-5.F 3.5.3-5.D 3.5.3-5.J 3.5.3-5.K 3.5.3-5.H	Quarter 1,2,3

Big Idea/Reporting Category3.5.3-5.K	**Concepts/Standards**	**Competencies/Eligible Content**	**Vocabulary**	**Standards**	**Pacing**
	How does changing technology impact the individual, culture, and environment?	developed or adapted when individual or societal needs and wants change. Judge technologies to determine the best one to use to complete a given task or meet a need. Determine factors that influence changes in a society's technological systems or infrastructure.	culture environment individual change infrastructure		
Technology and Engineering: Integration of Knowledge, Technologies, and Practices	How does technology and engineering relate to other content areas? How do advancements from one field impact another?	Explain how various relationships can exist between technology and engineering and other content areas Describe the properties of different materials. Identify the resources needed to get a technical job done, such as people, materials, capital, tools, machines, knowledge, energy, and time. Create a new product that improves someone's life.	relationship content exist discipline property application material capital resource improve invention innovation	3.5.3-5.X 3.5.3-5.W 3.5.3-5.Y 3.5.3-5.Z	Quarter 1,2,3
Technology and Engineering: Design in Technology & Engineering Education	Why is there no single correct solution in design? What is the value of iteration within the design process? How are requisite skills applied in technology and engineering design? How are designs influenced	Interpret how good design improves the human condition. Illustrate that there are multiple approaches to design. Identify why a product or system is not working properly. Demonstrate essential skills of the	Design system iteration troubleshooting solution constraint limitation criteria optimization criteria optimization	3.5.3-5.V 3.5.3-5.S 3.5.3-5.N 3.5.3-5.M 3.5.3-5.Q 3.5.3-5.R 3.5.3-5.P 3.5.3-5.O 3.5.3-5.T 3.5.3-5.U	Quarter 1,2,3

Big Idea/Reporting Category3.5.3-5.K	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	by universal principles and elements of design? How do criteria and constraints drive design?	engineering design process. Practice successful design skills. Apply tools, techniques, and materials in a safe manner as part of the design process. Evaluate the strengths and weaknesses of existing design solutions, including their own solutions. Describe requirements of designing or making a product or system. Apply universal principles and elements of design. Evaluate designs based on criteria, constraints, and standards.			

Science 6

Statement of Organization:
This course is designed for students who have successfully completed the sixth-grade science course. Students will show growth in the branches of science including the following: Life Science, Physical, Earth/Space, and Environmental Literacy and Sustainability.

Expected Levels of Achievement:
All students are expected to master the objectives taught by achieving at least 77% on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- drill and practice
- demonstration
- teacher observation
- portfolios
- projects
- standardized tests
- teacher-made tests
- oral presentations
- classroom discussion
- Benchmark assessments
- Computer based testing

Estimated Instructional Time: 120 clock hours (1 school year)

Sequence: These Items are highlighted below in order of sequence. (Life Science, Physical Science, Earth and Space Science, and Environmental Literacy and Sustainability)

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with the standards.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Cell Structure and Function (Life Science)	Conduct an investigation to provide evidence that living things are made of cells, either one cell or many different numbers and types of cells (3.1.6-8.A).	Students should be able to conduct investigations to provide evidence that living things are composed of cells, demonstrating the presence of one or many different numbers and types of cells.	Cells, investigation, evidence, cell types, scientific method and skills	3.1.6-8.A	Life Science 10 weeks
Human Body Systems	Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells (3.1.6-8.C).	Students should be able to use arguments supported by evidence to explain how the human body functions as a system of interacting subsystems composed of groups of cells.	Body systems, subsystems, cells, evidence	3.1.6-8.C	
Characteristics of Living Things	Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively (1.6-8.D).	Students should be able to construct explanations supported by evidence for how characteristic animal behaviors and specialized plant structures impact successful reproduction.	Instinctual behaviors, learned behaviors, social behaviors, pollination, reproductive structures	3.1.6-8.D	
Factors Affecting Growth	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms (3.1.6-8.E).	Students should be able to construct scientific explanations supported by evidence for how environmental (e.g., light, temperature, water, soil nutrients) and genetic factors influence organism growth.	Environmental factors, genetic factors, inheritance, Punnett square	3.1.6-8.E	
Energy Flow and Matter Cycling	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy in to and out of organisms (3.1.6-8.F).	Students should be able to construct scientific explanations supported by evidence for how photosynthesis contributes to the cycling of matter and flow of energy within ecosystems.	Photosynthesis, energy flow, matter cycling	3.1.6-8.F	
Atomic Structure and Properties (Physical Science)	Develop models to describe the atomic composition of simple molecules and extended structures (3.2.6-8.A).	Students should be able to develop models that describe the atomic composition of simple molecules and extended structures.	Atomic composition, molecules, extended structures	3.2.6-8.A	Physical Science 12 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Changes in Matter and Energy	Develop a model that predicts and describes changes in the particle motion, temperature, and state of a pure substance when thermal energy is added or removed (3.2.6-8.B).	Students should be able to develop a model that predicts and describes changes in the particle motion, temperature, and state of a pure substance in response to the addition or removal of thermal energy.	Particle motion, temperature, state change, thermal energy	3.2.6-8.B	
Materials and Their Properties	Gather and make sense of information to describe how synthetic materials come from natural resources and impact society (3.2.6-8.C).	Students should be able to gather and interpret information to explain how synthetic materials are derived from natural resources and their societal impacts.	Synthetic materials, natural resources, societal impacts	3.2.6-8.C	
Chemical Reactions and Energy Transfer	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred (3.2.6-8.D).	Students should be able to analyze data on substance properties to determine if a chemical reaction has occurred based on changes observed before and after interaction.	Chemical reactions, substance properties, data analysis, Atomic Mass, Atom	3.2.6-8.D	
Chemical Reactions and Energy Transfer	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes (3.2.6-8.F).	Students should be able to design, construct, test, and refine a device that utilizes chemical processes to release or absorb thermal energy.	Thermal energy, chemical processes, design project	3.2.6-8.F	
Forces and Motion	Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects. 3.2.6-8.G	Students should be able to apply Newton's Third Law to analyze and design solutions for problems involving the motion of two colliding objects	Newton’s Third Law, Action, Reaction, Force, Momentum, Collision	3.2.6-8.G	
Balanced and Unbalanced Forces	Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object. 3.2.6-8.H	Students should be able to differentiate between balanced and unbalanced forces; predict motion changes based on force data	Balanced Forces, Unbalanced Forces, Equilibrium, Vector	3.2.6-8.H	
Magnetic Force Factors	Ask questions about data to determine the factors that affect the strength of	Students should be able to identify how distance and charge magnitude affect	Magnetic Field, Magnetic Domain,	3.2.6-8.I	

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	electric and magnetic forces. 3.2.6-8.I	electric force; interpret data to explain these relationships	Ferromagnetic, Distance, Field Strength		
Forces and Fields (types of Interactions)	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. 3.2.6-8.K	Students should be able to observe and describe electric and magnetic field interactions between objects; analyze data to infer field presence	Field, Force, Electric Field, Magnetic Field, Gravitational Field, Non-contact Force	3.2.6-8.K	
Energy and Motion	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass and speed of an object. 3.2.6-8.L	Students should be able to analyze data to observe how changes in mass impact the kinetic energy of an object	Kinetic Energy, Mass, Speed, Velocity, Graph, Data Interpretation	3.2.6-8.L	
Thermal Energy Transfer	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer 3.2.6-8.M	Students should be able to investigate how different materials affect thermal energy transfer; test materials for insulation effectiveness	Thermal Energy, Conduction, Convection, Radiation, Insulation, Heat Transfer	3.2.6-8.M	
Energy and Matter Relationships	Plan an investigation to examine the relationship among energy transferred, type of matter, mass, and temperature change 3.2.6-8.N	Students should be able to analyze how temperature affects the kinetic energy of particles and how mass and type of matter influence this change	Thermal Energy, Conduction, Convection, Radiation, Insulation, Heat Transfer	3.2.6-8.N	
Kinetic Energy and Energy Transfer	Construct and support arguments showing that energy is transferred to or from an object when its kinetic energy changes 3.2.6-8.O	Students should be able to explain how work is done when an object's kinetic energy changes and how energy is transferred in the process	Kinetic Energy, Energy Transfer, Potential Energy, Conservation of Energy, System	3.2.6-8.O	

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Earth and Space Systems (Earth and Space Science)	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons (3.3.6-8.A).	Students should be able to develop and use models of the Earth-sun-moon system to explain the cyclic patterns of lunar phases, eclipses, and seasons.	Earth-sun-moon system, lunar phases, eclipses, seasons	3.3.6-8.A	Earth and Space Science 8 weeks
Earth and Space Systems	Develop and use a model to describe the role of gravity in the motion within galaxies and the solar system (3.3.6-8.B).	Students should be able to develop and use models to describe how gravity influences motion within galaxies and the solar system.	Gravity, motion, galaxies, solar system, Newtons Laws of Motion	3.3.6-8.B	
Earth and Space Systems	Analyze and interpret data to determine scale properties of objects in the solar system (3.3.6-8.C).	Students should be able to analyze and interpret data to determine the scale properties of objects within the solar system.	Scale properties, solar system, data analysis	3.3.6-8.C	
Weather Systems and Air Masses	Collect data to provide evidence for how the motion and complex interactions of air masses result in changes in weather conditions. 3.3.6-8.J	Students should be able to investigate how different air masses (e.g., cold, warm, dry, moist) interact to produce changes in weather patterns	Cold Front, Warm Front, Occluded Front, Stationary Front, Humidity, Temperature	3.3.6-8.J	
Natural Hazards and Risk Assessment	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. 3.3.6-8.L	Students should be able to investigate the role of technology in forecasting natural hazards (earthquakes, floods, hurricanes) and mitigating their effects	Natural Hazards, Catastrophic Events, Forecasting, Risk Assessment, Data Interpretation	3.3.6-8.L	
Agricultural and Environmental Systems and Resources Agricultural Systems (Environmental Literacy and Sustainability)	Develop a model to describe how agricultural and food systems function, including the sustainable use of natural resources and the production, processing, and management of food, fiber, and energy (3.4.6-8.A).	Students should be able to develop models describing how agricultural and food systems function, incorporating sustainable practices and the production, processing, and management of food, fiber, and energy.	Agricultural systems, food systems, sustainability, natural resources, production, processing, management	3.4.6-8.A	(Environmental Literacy and Sustainability) 5 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Environmental Problem-Solving	Design a solution to an environmental issue in which individuals and societies can engage as stewards of the environment. 3.4.6-8.H	Engage in problem-solving activities to create solutions for pressing environmental challenges (e.g., waste, pollution, resource depletion)	Problem-Solving, Innovation, Environmental Impact, Climate Change, Ecosystem	3.4.6-8.H	
Regional Environmental Conditions	Construct an explanation that describes regional environmental conditions and their implications on environmental justice and social equity. 3.4.6-8.I	Investigate how regional environmental factors, such as pollution or resource availability, impact the well-being of communities	Pollution, Resource Distribution, Air Quality, Water Quality, Access to Resources	3.4.6-8.I	Finals and Prep for that will be 1 week

Science 7

Statement of Organization:
This course is designed to expand upon student general scientific knowledge as built by classes in grades 1-6. Students will expand knowledge and understanding of life science, physical science, earth science, and environmental literacy.

Expected Levels of Achievement:
Students are expected to achieve at least a 77% all graded assessments.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- drill and practice
- demonstration
- teacher observation
- projects
- standardized tests
- teacher-made tests
- oral presentations
- classroom discussion
- Computer based testing

Estimated Instructional Time:
120 hours, over 1 school year. 35 weeks of instruction and 1 week of final exams/prep for those exams

Sequence
It is anticipated that the topics will be gone over in the following order:

- Life Science
  - Information processing
  - Ecology: resource availability
  - Mechanisms of adaptation
  - Evolutionary evidence from fossils
- Earth/Environmental Science
  - Geologic time
  - Matter cycling
  - Sustainability of natural resources
  - Environmental decision making and advocacy
- Physical Science
  - Gravitational interactions
  - Potential Energy and System Interactions

Technology Integration:
In addition to print resources, students will use technology (Chromebooks, microscopes, SMART board, software simulations, etc.) to some extent almost daily, or at least as often as needed to enhance student understanding of scientific concepts.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Anticipated Pacing
Life Science Information processing	Processing of information received through the body's senses	Gather and synthesize information about how sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage	Nerves, neurons, senses, sensory receptors	3.1.6-8.H	2 weeks
Ecosystems: Resource availability and impact of populations on that ecosystem	Relationships and interactions among organisms and resources and effects of resource availability on organisms and population levels.	Plan and conduct investigations, use data to describe interactions in ecosystems. Interpret and model that data. Predict patterns in ecosystem interactions. Evaluate competing design solutions for maintaining biodiversity and ecosystem services	Ecosystem, population, interaction, resource Resource availability, population dynamics, species interaction, Resilience, biodiversity, ecosystem stability, disruption	3.1.6-8.I 3.1.6-8.J 3.1.6-8.L 3.1.6-8.U	6 weeks
Mechanisms of Adaptation	Natural selection and trait adaptations in populations.	Model natural selection, use data to explain population adaptations.	Adaptation, natural selection, variation, survival advantage	3.1.6-8.T	3 weeks
Evolutionary Evidence from Fossils	Fossil record analysis and evolutionary relationships.	Analyze data from fossils, construct explanations for evolutionary changes.	Fossil record, evolution, adaptation, common ancestry	3.1.6-8.O 3.1.6-8.P	3 weeks
Earth Science Geologic Time and Earth's Changes	Earth's history through rock formations and the geologic time scale.	Analyze rock strata, explain geological time in Earth's history.	Geologic time scale, rock strata, fossilization, age dating	3.3.6-8.D 3.3.6-8.E	3 weeks
Matter cycling	Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales,	Develop and use a model to describe the changes we observe on Earth ehich are the result of energy flowing and matter cycling between interconnected systems (the geosphere, hydrosphere, atmosphere, and	melting crystallization weathering deformation sedimentation energy flow	3.3.6-8.F	3 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Anticipated Pacing
	including the atomic scale.	biosphere)…..	stability and change		
Plate Tectonics	Patterns in rates of change and other numerical relationships can provide information about natural systems	Analyze and interpret data to provide evidence for plate tectonics, explaining the past and current movements and features of the rocks at Earth's surface.	Fossils seafloor ridge trench Pangea tectonic	3.3.6-8.G	3 weeks
Sustainability of Natural Resources	The impact of human activities on resources and sustainable practices.	Assess human impact, design solutions to reduce environmental footprint.	Sustainability, conservation, resource management, renewable	3.3.6-8.K 3.4.6-8.B	4 weeks
Environmental Decision-Making and Advocacy	Environmental literacy skills, evaluation of solutions for sustainability.	Develop solutions to environmental issues, advocate for sustainability.	Stewardship, advocacy, environmental literacy, ecosystem services	3.4.6-8.G	3 weeks
Physical Science Gravitational Interactions	Gravitational force and its relation to mass	Find and use evidence to show that gravitational interactions are attractive, and are based on masses of interacting forces	Gravity, mass	3.2.6-8.J	2 weeks
Potential Energy and System Interactions	Energy changes in systems due to distance-based interactions.	Model energy transfer, describe potential energy relationships.	Potential energy, interaction, distance, system	3.2.6-8.P	3 weeks
Prep for and take finals	All of the above	All of the above	All of the above	All of the above	1 week

Science 8

Statement of Organization
This course is designed to expand scientific knowledge in Life Science, Physical Science, Earth and Space Science, and Environmental Literacy and Sustainability. Students will deepen their understanding of scientific concepts and develop skills in evidence-based reasoning, data analysis, and problem-solving through practical applications and real-world connections.

Expected Levels of Achievement
Students are expected to achieve 77% on grades and:

1. Demonstrate advanced understanding of scientific processes and concepts in various fields.
2. Engage in inquiry-based investigations and design processes for scientific and engineering challenges.
3. Analyze data and construct models to represent scientific phenomena.
4. Apply critical thinking and scientific knowledge to propose solutions for environmental issues.

Methods of Evaluation
Student competence will be assessed through:

- Laboratory investigations and experimentation
- Data analysis and graph interpretation exercises
- Project-based learning and presentations
- Written quizzes, tests, and reflection activities
- Research projects and peer collaboration

Estimated Instructional Time
35 Weeks / +1 Week of Finals

Expected Sequence
- Life Science ~ Structure and Function
- Life Science ~ Growth and Development of Organisms
- Life Science ~ Organization for Matter and Energy Flow in Ecosystems
- Life Science ~ Interdependent Relationships in Ecosystems
- Life Science ~ Cycles of Matter and Energy Transfer in Ecosystems
- Life Science ~ Inheritance of Traits
- Life Science ~ Variation of Traits
- Life Science ~ Evidence of Common Ancestry and Diversity
- Life Science ~ Natural Selection
- Life Science ~ Adaptation
- Physical Science ~ Chemical Reactions
- Physical Science ~ Wave Properties

- Physical Science ~ Electromagnetic Radiation
- Physical Science ~ Information Technologies and Instrumentation
- Earth & Space Science ~ Earth Materials and Systems
- Earth and Space Science ~ The Roles of Water in Earth's Surface Processes
- Earth and Space Science ~ Human Impact on the Earth
- Environmental Literacy & Sustainability ~ Agricultural and Environmental Systems and Resources
- Environmental Literacy & Sustainability ~ Environmental Literacy and Sustainability and Investigating Environmental Issues
- Environmental Literacy & Sustainability ~ Environmental Literacy and Sustainability and Environmental Experiences

Technology Integration

A SMART board will be used almost daily to present information. Students will use Chromebooks most days for research, producing projects, running simulations, etc.

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Life Science ~ Structure and Function Organisms have characteristic structures that enable functions and behaviors that allow them to grow, reproduce, and die.	All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	Conduct an investigation to provide evidence that living things are made of cells, either one cell or many different numbers of cells.	organism cells unicellular multicellular phenomena scale	3.1.6-8.A	2 Weeks
Life Science ~ Structure and Function Organisms have characteristic structures that enable functions and behaviors that allow them to grow, reproduce, and die.	Within cells, special structures are responsible for specific functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.	Develop and use a model to describe the function of a cell as a whole and the ways that parts of cells contribute to the function.	cell structures functions of cells membrane models systems relationships	3.1.6-8.B	2 Weeks
Life Science ~ Growth and Development of Organisms The characteristic structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age. (through the life cycle)	Genetic factors as well as local conditions affect growth.	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	environmental factors genetic factors local conditions scientific explanation organisms	3.1.6-8.E	1 Week
Life Science ~ Organization for Matter and Energy Flow in Ecosystems How do organisms obtain and use the matter and energy they need to live and grow?	The structures, functions, and behaviors of organisms allow them to obtain, use, transport, and remove the matter and energy needed to live.	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. *Photosynthesis *Cellular Respiration	cellular respiration chemical reaction conservation of matter cycle models mechanisms molecules physical processes chemical processes	3.1.6-8.G	2 Weeks
Life Science ~ Interdependent Relationships in Ecosystems	Organisms, and populations of organisms, are dependent on their environmental interactions both	Analyze and interpret data to provide evidence for the effects of resource availability on	Organisms populations environmental	3.1.6-8.I	2 Weeks

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
How do organisms interact with living and non-living environments to obtain matter and energy?	with other living things and with non-living factors. In any ecosystem, organisms and requirements for food, water, oxygen, or other resources may compete for limited resources, access to which consequently constrains their growth and reproduction. Growth of organisms and populations are limited by access to resources.	organisms and populations of organisms in an ecosystem.	interactions nonliving factors biotic abiotic ecosystem resources cause and effect limiting factors competition		
Life Science ~ Cycles of Matter and Energy Transfer in Ecosystems The cycling of matter and the flow of energy within ecosystems occur through interactions among different organisms and between organisms and the physical environment.	Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.	Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.	transfer of energy energy flow natural system food webs models ecosystem producers consumers decomposers physical environment	3.1.6-8.K	2 Weeks
Life Science ~ Inheritance of Traits Offspring resemble, but are not identical to, their parents due to traits being passed from one generation to the next via genes	Genes are in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.	cells genes mutations chromosomes proteins structure and function traits sexual reproduction microscopic structures	3.1.6-8.M	2 Weeks

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	(mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral.		systems models		
Life Science ~ Variation of Traits Variation among individuals of the same species can be explained by both genetic and environmental factors	Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary) Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two chromosomes and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.	asexual reproduction sexual reproduction offspring genetic variation genetic information organisms random allele gene natural systems cause and effect predict	3.1.6-8.N	2 Weeks
Life Science ~ Evidence of Common Ancestry and Diversity Comparisons between species	Anatomical similarities and differences between various organisms living today and between them and organisms in	Apply scientific ideas to construct an explanation for anatomical similarities and differences among modern	Fossil organisms evolutionary relationships	3.1.6-8.P	2 Weeks

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
provides evidence that species evolved from common ancestors which explains the similarities and differences between species.	the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent	organisms and between modern and fossil organisms to infer evolutionary relationships.	anatomical infer relationships patterns		
Life Science ~ Evidence of Common Ancestry and Diversity Comparisons between species provides evidence that species evolved from common ancestors which explains the similarities and differences between species.	Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.	Analyze displays of pictorial data to compare patterns of similarities in anatomical structures across multiple species to identify relationships not evident in the fully formed anatomy.	embryo embryological development anatomy species linear relationships nonlinear relationships patterns	3.1.6-8.Q	2 Weeks
Life Science ~ Natural Selection In any environment individuals with particular traits may be more likely than others to survive and produce offspring.	In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.	Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.	inheritance traits bias technologies inheritance organism genetic variation selective breeding genes offspring relationships in systems probability genetic engineering advantageous trait disadvantageous trait cause and effect	3.1.6-8.R	2 Weeks
Life Science ~ Natural Selection In any environment individuals with particular traits may be more likely than others to survive and produce offspring.	Natural selection leads to the predominance of certain traits in a population, and the suppression of others.	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.	traits genetic variations population natural selection systems survival probability variables cause and effect relationships	3.1.6-8.S	2 Weeks
Life Science ~ Adaptation When the environment changes,	Adaptation by natural selection acting over generations is one important process by which	Use mathematical representations to support explanations of how natural	adaptation natural selection cause and effect species	3.1.6-8.T	1 Week

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
some individuals in a population may have traits that provide a reproductive advantage which over many generations can change the make-up of a population.	species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	selection may lead to increases and decreases of specific traits in populations over time.	adaptation generation environmental conditions probability traits distribution of traits		
Physical Science ~ Chemical Reactions The atoms of some substances combine or rearrange to form new substances that have different properties.	Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change.	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	chemical reaction conservation of mass open vs. close system yields reactants products matter models	3.2.6-8.E	2 Weeks
Physical Science ~ Wave Properties Waves are repeating patterns of motion that transfer energy and information without transferring matter.	A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	data amplitude frequency crest trough wavelength patterns wave design solutions	3.2.6-8.Q	*1 Week
Physical Science ~ Electromagnetic Radiation Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave pattern of changing electric and magnetic	A sound wave needs a medium through which it is transmitted. When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the	Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.	waves frequency color light reflection transmission absorption models properties	3.2.6-8.R	*1 Week

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
fields that interact with matter.	light. The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. However, because light can travel through space, it cannot be a matter wave, like sound or water waves				
Physical Science ~ Information Technologies and Instrumentation Useful modern technologies and instruments have been designed based on an understanding of waves and their interactions with matter.	Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	waves transmission structure and function design analog digital	3.2.6-8.S	*1 Week
Earth & Space Science ~ Earth Materials and Systems Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems (the geosphere, hydrosphere, atmosphere, and biosphere).	All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. This energy is derived from the sun and Earth’s hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth’s materials and living organisms.	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	chemical/ physical changes melting crystallization weathering deformation sedimentation energy flow stability and change	3.3.6-8.F	1 Week
Earth and Space Science ~ The Roles of Water in Earth’s Surface	Water continually cycles among land, ocean, and atmosphere via	Develop a model to describe the cycling of water through Earth's	hydrologic cycle transpiration	3.3.6-8.H	1 Week

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Processes Water's presence and properties impact Earth's ecosystems and surface features.	transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity.	systems driven by energy from the sun and the force of gravity.	evaporation condensation crystallization precipitation respiration glaciers global		
Earth and Space Science ~ The Roles of Water in Earth's Surface Processes Water's presence and properties impact Earth's ecosystems and surface features.	Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	latitude altitude thermal energy radiation input output salinity density climate weather system models	3.3.6-8.I	1 Week
Earth and Space Science ~ Human Impact on the Earth Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.	Human activities, such as the release of greenhouse gases from burning fossil fuels are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	human activities natural processes greenhouse gas carbon dioxide stability and change climate factors climate science	3.3.6-8.O	1 Week

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.				
Earth Science ~ Human Impact on the Earth Human activities in agriculture, industry, and everyday life has an impact on the land, rivers, ocean, and air.	Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environment can have different impacts (negative and positive) for different living things. Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise	Apply scientific principles to design a method for monitoring and minimizing human impact on the environment.	water usage land usage pollution cause and effect natural habitats extinction societal needs	3.3.6-8.M	1 Week
Earth Science ~ Human Impact on the Earth Human activities in agriculture, industry, and everyday life has an impact on the land, rivers, ocean, and air.	Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise	Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems.	per-capita consumption population natural resources cause and effect	3.3.6-8.N	1 Week
Environmental Literacy & Sustainability ~ Agricultural and Environmental Systems and Resources Watersheds and wetlands function as interconnected	Emphasis is on comparing and contrasting data from two or more societies and cultures to draw evidence-based conclusions. Examples could include how different societies and cultures manage agriculture, recycling and	Examine, develop, analyze, and interpret how watersheds function as a system and are impacted by external factors. Engage in informed use of land and water to contribute to a positive impact on local	Erosion Runoff Agriculture land use (im-)permeable riparian zone Filtration	3.4.6-8.C	1 Week

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
systems that support, impact, and are influenced by living things	waste management, fossil fuels, land development, etc.	watersheds and wetlands.	absorption water column macroinvertebrates ecological function nutrient management watershed wetlands floodplain		
Environmental Literacy & Sustainability ~ Environmental Literacy and Sustainability and Investigating Environmental Issues The environment provides multi-faceted opportunities to develop and apply interdisciplinary literacy skills to investigate complex issues at various scales.	Human activities have significantly altered the biosphere, sometimes damaging, or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	Gather, read, and synthesize information from multiple sources to investigate how Pennsylvania environmental issues affect Pennsylvania's human and natural systems.	non-governmental organization advocacy perspectives	3.4.6-8.D	1 Weeks
Environmental Literacy & Sustainability ~ Environmental Literacy and Sustainability and Environmental Experiences Conducting scientific investigations using place-based inquiry and authentic, outdoor field experience(s) is essential to understanding local environmental issues.	Emphasis is on collecting information from a local outdoor area to accurately describe that environment. Examples could include weather data, stream studies, data on air quality, biodiversity assessments, etc. Interdependent Relationships in Ecosystems Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. Weather and climate are	Evaluate and engage in discussion surrounding local and global issues that relate to resource use and management. Examine, analyze, interpret, and apply how an individual and community impacts the use and management of natural resources.	variable, factors sequence variability average data analysis varve rates parameter indicators correlations	3.4.6-8.E	1 Week

Big Idea/ Reporting Category	Concepts/ Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.				
**PSSA EXAMS / FINALS					1-2 Weeks

Earth and Environmental Science

Statement of Organization:
This course is designed to emphasize the earth's structure, movement and basic function. The impact of the earth and its components will also be addressed as it impacts the environment and ecological systems

Expected Levels of Achievement:
Students are expected to learn the relationship of science to their lives using various science process skills, problem solving skills and inductive and deductive reasoning. The students are expected to achieve mastery of the skills and concepts taught by obtaining a minimum of eighty (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods: Teacher-Made Tests, Projects, Self-Evaluation, Portfolios, Observation, Experimentation, Drill and Practice, Demonstrations, Laboratory Activities, Classroom Discussions

Estimated Instructional Time:
This is a one credit course which will meet for a minimum of 120 clock hours.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology such as laptop computers in class. They will also use various lab resources which are meant to enhance the educational process. They will use these different resources at different times throughout the course.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Observations of the sky can be explained by predictable patterns of the movement of the Earth, moon, sun and planets.	What are the predictable patterns caused by the Earth's movement in the solar system.	Developing and Using Models Use a model to provide mechanistic accounts of phenomena.	Intensity orbit climate axis rotation ice age tectonic activity circulation glaciation energy cause and effect	3.3.9-12.E Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.	1 week
We can infer Earth's planetary history by features we observe today.	How do people reconstruct and date events in Earth's planetary history?	Engaging in Argument from Evidence Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments	plate tectonics continental drift erosion crust mid-ocean ridges plate interactions radiometric dating magma subduction patterns	3.3.9-12.F Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.	2 weeks
Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems(the geosphere, hydrosphere, atmosphere and biosphere).	How and why is the earth constantly changing? How do earth's major systems interact?	Analyzing and Interpreting Data Analyze data using computational models in order to make valid and reliable scientific claims.	climate geosphere hydrosphere atmosphere biosphere feedback greenhouse gases glacial ice runoff erosion ground water humidity radiation systems	3.3.9-12.H Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes changes to other Earth systems.	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Changes we observe on Earth are the result of energy flowing and matter cycling between interconnected systems(the geosphere, hydrosphere, atmosphere and biosphere).	How and why is earth constantly changing? How do earth's major systems interact?	Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	magnetic field core mantle crust seismic waves earthquakes plate tectonics convection energy radioactive decay solid liquid seismic/magnetic density plate boundaries magnetic field polar reversal cycling model	3.3.9-12.I Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.	2 weeks
Plate tectonics explains the past and current movements and features of the rocks at the Earth's surface.	Why do continents move, and what cause earthquakes and volcanoes?	Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system	Mountains valleys plateaus trenches ridges seamounts volcanism mountain building tectonic uplift weathering erosion mode	3.3.9-12.J Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean floor features.	2 week
Water's presence and properties impact Earth's ecosystems and surface features.	How do the properties and movements of water shape Earth's surface and affect its systems?	Planning and Carrying Out Investigations Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on	heat capacity density solid liquid Gas vapor polarity (molecular	3.3.9-12.K Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	2 week

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	structure) air stream table transportation deposition soil moisture chemical weathering rust		
Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms and living things.	What regulates weather and climate?	Developing and Using Models Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	carbon cycle hydrosphere atmosphere geosphere biosphere carbon dioxide models system	3.3.9-12.L Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere	2 weeks
Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms and living things.	What regulates weather and climate?	Using Mathematics and Computational Thinking Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations.	hydrosphere, atmosphere cryosphere geosphere biosphere atmospheric CO2 photosynthetic biomass ocean acidification system models	3.3.9-12.M Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.	2 weeks
Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms and living things.	What regulates weather and climate?	Analyzing and Interpreting Data Analyze data using computational models in order to make valid and reliable scientific claims.	sea-level climate model temperature precipitation pH reversible	3.3.9-12.S Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
				change and associated future impacts to Earth systems.	
Life and the planet's nonliving systems impact one another	How do living organisms alter Earth's processes and structure?	Engaging in Argument from Evidence Construct an oral and written argument or counter-arguments based on data and evidence.	coevolution atmospheric composition photosynthetic organisms biosphere weathering respiration deposition feedback mechanisms	3.3.9-12.N Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.	2 weeks
All materials, energy and fuels that humans use are derived from natural sources, some of which are renewable over time and others are not.	How do humans depend on Earth's resources?	Constructing Explanations and Designing Solutions Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	environmental factors hazard population size and migration patterns causal relationships correlational relationships	3.3.9-12.O Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	2 weeks
Natural processes can cause sudden or gradual changes to Earth's systems, some of which may adversely affect humans.	How do natural hazards affect individuals and societies?	Engaging in Argument from Evidence Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).	cost-benefit ratios mineral energy reserve constraints technological systems	3.3.9-12.P Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	2 weeks
Human activities in agriculture, industry and everyday life has an impact	How do humans change the planet?	Using Mathematics and Computational Thinking Create a computational model or simulation of a phenomenon, designed	natural resource ecosystem sustainability	3.3.9-12.Q Create a computational simulation to illustrate	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
on the land, rivers, ocean and air.		device, process, or system.	biodiversity population feedback stabilizes destabilizes system	the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	
Human activities in agriculture, industry and everyday life has an impact on the land, rivers, ocean and air.	How do humans change the planet?	Constructing Explanations and Designing Solutions Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	tradeoffs benefits/costs/risks stability	3.3.9-12.R Evaluate or refine a technological solution that reduces the impact of human activities on natural systems.	2 weeks
Ecosystems are complex systems that include both living(biotic) and non-living(abiotic) components that interact with each other.	How do organisms interact with the living and non-living environments to obtain matter and energy?	Using Mathematical and Computational Thinking Simple computational simulations are created and used based on mathematical models of basic assumptions. Use mathematical representations of phenomena or design solutions to support claims.	food chains/webs trophic levels energy conservation of energy	3.1.9-12.H Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	1 week
Ecosystems are complex systems that include both living(biotic) and non-living(abiotic) components that interact with each other.	How do organisms interact with the living and non-living environments to obtain matter and energy?	Using Mathematics and Computational Thinking Simple computational simulations are created and used based on mathematical models of basic assumptions. Use mathematical and/or computational representations of phenomena or design solutions to support explanations.	carrying capacity limiting factors ecosystem predation competition biotic abiotic scale proportion	3.1.9-12.I Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.	1 week
The cycling of matter and the flow of energy within ecosystems occur through interactions among different organisms and between	How do matter and energy move through an ecosystem?	Constructing Explanations and Designing Solutions Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations,	anaerobic respiration aerobic respiration photosynthesis cellular respiration	3.1.9-12.J Construct and revise an explanation based on evidence for the cycling of matter and	1 week

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
organisms and the physical environment.		models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	energy transfer	flow of energy in aerobic and anaerobic conditions.	
The cycling of matter and the flow of energy within ecosystems occur through interactions among different organisms and between organisms and the physical environment.	How do matter and energy move through an ecosystem?	Using Mathematics and Computational Thinking Simple computational simulations are created and used based on mathematical models of basic assumptions. Use mathematical representations of phenomena or design solutions to support and revise explanations.	carrying capacity limiting factors biodiversity biotic abiotic population ecosystem predation competition	3.1.9-12.L Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.	1 week
As the environment and populations of species change, there are resulting changes in the environment.	How do environmental changes impact the environment?	Engaging in Argument from Evidence Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.	ecological relationships niche succession organism	3.1.9-12.M Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem	1 week
As the environment and populations of species change, there are resulting changes in the ecosystem.	How do environmental changes impact ecosystems?	Constructing Explanations and Designing Solutions Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations.	human disturbances ecosystem biodiversity	3.1.9-12.N Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and	1 week

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
				biodiversity.	
When the environment changes, some individuals in a population may have traits that provide a reproductive advantage which over many generations can change the make up of a population.	How does the environment influence populations of organisms over multiple generations?	Using Mathematics and Computational Thinking Simple computational simulations are created and used based on mathematical models of basic assumptions. Create or revise a simulation of a phenomenon, designed device, process, or system.	biodiversity speciation biological extinction human disturbances	3.1.9-12.V Create or revise a simulation to test a solution to mitigate the adverse impacts of human activity on biodiversity.	1 week
When the environment changes, some individuals in a population may have traits that provide a reproductive advantage which over many generations can change the make up of a population.	How does the environment influence populations of organisms over multiple generations?	Constructing Explanations and Designing Solutions Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	Adaptation Biological fitness natural selection evolution	3.1.9-12.W Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	1 week
When the environment changes, some individuals in a population may have traits that provide a reproductive advantage which over many generations can change the make up of a population.	How does the environment influence populations of organisms over multiple generations?	Engaging in Argument from Evidence Arguments may also come from current or historical episodes in science. Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.	Biodiversity species speciation extinction divergent evolution convergent evolution	3.1.9-12.X Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.	1 week

AP Environmental Science

Statement of Organization:
This course is designed to allow students to cultivate their understanding of the interrelationships of the natural world through inquiry-based lab investigations and field work as they explore concepts like the four Big Ideas; energy transfer, interactions between earth systems, interactions between different species and the environment, and sustainability.

Expected Levels of Achievement:
Students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects. Students are also expected to pass the AP exam with a score of 3 or higher.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Lab reports
- Observation
- Presentations
- Projects
- Teacher-made tests
- AP Exam

Estimated Instructional Time:
AP Environmental Science is offered to students in grades ten through twelve who have successfully completed biology and meets for a minimum of one hundred twenty clock hours for one credit.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

- The Living World: Ecosystems
- The Living World: Biodiversity
- Populations
- Earth Systems and Resources
- Land and Water Use
- Energy Resources and Consumption
- Atmospheric Pollution
- Aquatic and Terrestrial Pollution
- Global Change

Technology Integration:
In addition to print resources, students will use technology... (when, why, how???)

- Internet resources to research topics and gather information
- Vernier LabPro probes and software to gather and analyze data
- Excel to graph data and create data sets
- AP Classroom online resources and assessments

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
The Living World: Ecosystems	Ecosystems are the result of biotic and abiotic interactions. Energy can be converted from one form to another	Explain how the availability of resources influences species interactions. Describe the global distribution and principal environmental aspects of terrestrial biomes. Describe the global distribution and principal environmental aspects of aquatic biomes. Explain the steps and reservoir interactions in the carbon cycle. Explain the steps and reservoir interactions in the nitrogen cycle. Explain the steps and reservoir interactions in the phosphorus cycle. Explain the steps and reservoir interactions in the hydrologic cycle. Explain how solar energy is acquired and transferred by living organisms Explain how energy flows and matter cycles through trophic levels. Determine how the energy decreases as it flows through ecosystems Describe food chains and food webs, and their constituent members by trophic level.	Ecosystem Terrestrial biome Aquatic biome Carbon cycle Nitrogen cycle Phosphorus cycle Hydrologic cycle Primary productivity Trophic levels 10% rule Food chain Food web	ERT-1.A.1 ERT-1.A.2 ERT-1.A.3 ERT-1.B.1 ERT-1.B.2 ERT-1.B.3 ERT-1.B.4 ERT-1.C.1 ERT-1.C.2 ERT-1.C.3 ERT-1.D.1 ERT-1.D.2 ERT-1.D.3 ERT-1.D.4 ERT-1.E.1 ERT-1.E.2 ERT-1.E.3 ERT-1.E.4 ERT-1.F.1 ERT-1.F.2 ERT-1.F.3 ERT-1.G.1 ERT-1.G.2 ENG-1.A.1 ENG-1.A.2 ENG-1.A.3 ENG-1.A.4 ENG-1.A.5 ENG-1.B.1 ENG-1.B.2 ENG-1.B.3 ENG-1.C.1 ENG-1.C.2 ENG-1.D.1 ENG-1.D.2	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
The Living World: Biodiversity	Ecosystems have structure and diversity that change over time.	Explain levels of biodiversity and their importance to ecosystems. Describe ecosystem services. Describe the results of human disruptions to ecosystem services. Describe island biogeography. Describe the role of island biogeography in evolution. Describe ecological tolerance Explain how natural disruptions, both short and long-term, impact an ecosystem. Describe how organisms adapt to their environment. Describe ecological succession. Describe the effect of ecological succession on ecosystems.	Biodiversity Ecosystem services Island biogeography Ecological tolerance Adaptations Ecological succession	ERT-2.A.1 ERT-2.A.2 ERT-2.A.3 ERT-2.A.4 ERT-2.A.5 ERT-2.B.1 ERT-2.C.1 ERT-2.D.1 ERT-2.D.2 ERT-2.E.1 ERT-2.F.1 ERT-2.F.2 ERT-2.G.1 ERT-2.G.2 ERT-2.G.3 ERT-2.G.4 ERT-2.G.5 ERT-2.G.6 ERT-2.H.1 ERT-2.H.2 ERT-2.I.1 ERT-2.I.2 ERT-2.I.3 ERT-2.J.1 ERT-2.J.2	4 weeks
Populations	Populations change over time in reaction to a variety of factors Human populations change in reaction to a variety of factors, including social and cultural factors	Identify differences between generalist and specialist species. Identify differences between K- and r-selected species. Explain survivorship curves. Describe carrying capacity.	Generalist Specialist K-selected species r-selected species Survivorship curve Carrying capacity Population growth Age structure diagram Total fertility rate	ERT-3.A.1 ERT-3.B.1 ERT-3.B.2 ERT-3.B.3 ERT-3.B.4 ERT-3.B.5 ERT-3.C.1 ERT-3.C.2 ERT-3.D.1 ERT-3.E.1	5 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		Describe the impact of carrying capacity on ecosystems. Explain how resource availability affects population growth. Explain age structure diagrams. Explain factors that affect total fertility rate in human populations. Explain how human populations experience growth and decline. Define the demographic transition.	Population dynamics Demography Demographic transition	ERT-3.F.1 ERT-3.F.2 ERT-3.F.3 ERT-3.F.5 EIN-1.A.1 EIN-1.A.2 EIN-1.B.1 EIN-1.B.2. EIN-1.B.3 EIN-1.C.1 EIN-1.C.2 EIN-1.C.3 EIN-1.C.4 EIN-1.D.1 EIN-1.D.2	
Earth Systems and Resources	Earth's systems interact, resulting in a state of balance over time. Most of the Earth's atmospheric processes are driven by input of energy from the sun.	Describe the geological changes and events that occur at convergent, divergent, and transform plate boundaries. Describe the characteristics and formation of soil. Describe similarities and differences between properties of different soil types. Describe the structure and composition of the Earth's atmosphere. Explain how environmental factors can result in atmospheric circulation. Describe the characteristics of a watershed. Explain how the sun's energy affects the	Plate tectonics Erosion Soil composition Troposphere Stratosphere Hadley cell Jet stream Watershed El Nino La Nina	ERT-4.A.1 ERT-4.A.2 ERT-4.A.4 ERT-4.A.5 ERT-4.B.1 ERT-4.B.2 ERT-4.B.3 ERT-4.C.1 ERT-4.C.2 ERT-4.C.3 ERT-4.C.4 ERT-4.D.1 ERT-4.D.2 ERT-4.E.1 ERT-4.F.1 ENG-2.A.1 ENG-2.A.2 ENG-2.A.3 ENG-2.A.4	2 week

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		Earth's surface. Describe how the Earth's geography affects weather and climate. Describe the environmental changes and effects that result from El Niño or La Niña events (El Niño–Southern Oscillation).		ENG-2.A.5 ENG-2.B.1 ENG-2.B.2 ENG-2.C.1 ENG-2.C.2	
Land and Water Use	When humans use natural resources, they alter natural systems. Humans can mitigate their impact on land and water resources through sustainable use.	Explain the concept of the tragedy of the commons. Describe the effect of clearcutting on forests. Describe changes in agricultural practices. Describe agricultural practices that cause environmental damage. Describe different methods of irrigation. Describe the benefits and drawbacks of different methods of irrigation. Describe the benefits and drawbacks of different methods of pest control. Identify different methods of meat production. Describe the benefits and drawbacks of different methods of meat production. Describe causes of and problems related to overfishing.	Tragedy of the Commons Clearcutting The Green Revolution Drip Irrigation CAFO Surface mining Subsurface mining Tailings Overburden Ore Gange Ecological footprint Sustainability Urban runoff IPM Aquaculture	EIN-2.A.1 EIN-2.B.1 EIN-2.B.2 EIN-2.C.1 EIN-2.C.2 EIN-2.D.1 EIN-2.E.1 EIN-2.E.2 EIN-2.F.1 EIN-2.F.2 EIN-2.F.3 EIN-2.F.4 EIN-2.F.5 EIN-2.F.6 EIN-2.F.7 EIN-2.G.1 EIN-2.G.2 EIN-2.H.1 EIN-2.I.1 EIN-2.I.2 EIN-2.I.3 EIN-2.I.4 EIN-2.I.5 EIN-2.I.6 EIN-2.J.1 EIN-2.K.1	4 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		Describe natural resource extraction through mining. Describe ecological and economic impacts of natural resource extraction through mining. Describe the effects of urbanization on the environment. Explain the variables measured in an ecological footprint. Explain the concept of Sustainability Describe methods for mitigating problems related to urban runoff. Describe integrated pest management. Describe the benefits and drawbacks of integrated pest management (IPM). Describe sustainable agricultural and food production practices. Describe the benefits and drawbacks of aquaculture. Describe methods for mitigating human impact in forests.		EIN-2.K.2 EIN-2.L.1 EIN-2.L.2 EIN-2.M.1 EIN-2.M.2 EIN-2.M.3 EIN-2.M.4 EIN-2.N.1 STB-1.A.1 STB-1.A.2 STB-1.B.1 STB-1.C.1 STB-1.D.1 STB-1.D.2 STB-1.E.1 STB-1.E.2 STB-1.E.3 STB-1.F.1 STB-1.F.2 STB-1.G.1 STB-1.G.2 STB-1.G.3	
Energy Resources and Consumption	Humans use energy from a variety of sources, resulting in positive and negative	Identify differences between nonrenewable and renewable energy sources. Describe trends in energy consumption.	Renewable resource Nonrenewable resource Fossil fuels Biomass	ENG-3.B.1 ENG-3.B.2 ENG-3.B.3 ENG-3.B.4	5 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	consequences.	Identify types of fuels and their uses. Identify where natural energy resources occur. Describe the use and methods of fossil fuels in power generation. Describe the effects of fossil fuels on the environment. Describe the use of nuclear energy in power generation. Describe the effects of the use of nuclear energy on the environment. Describe the effects of the use of biomass in power generation on the environment. Describe the use of solar energy in power generation. Describe the effects of the use of solar energy in power generation on the environment. Describe the use of hydroelectricity in power generation. Describe the effects of the use of hydroelectricity in power generation on the environment. Describe the use of geothermal energy in power generation.	Hydroelectric power Geothermal energy Hydrogen fuel cell Conservation	ENG-3.B.5 ENG-3.C.1 ENG-3.C.2 ENG-3.C.3 ENG-3.C.4 ENG-3.C.5 ENG-3.C.6 ENG-3.C.7 ENG-3.D.1 ENG-3.E.1 ENG-3.E.2 ENG-3.E.3 ENG-3.F.1 ENG-3.G.1 ENG-3.G.2 ENG-3.G.3 ENG-3.G.4 ENG-3.H.1 ENG-3.H.2 ENG-3.I.1 ENG-3.I.2 ENG-3.J.1 ENG-3.J.2 ENG-3.J.3 ENG-3.K.1 ENG-3.L.1 ENG-3.L.2 ENG-3.M.1 ENG-3.N.1 ENG-3.O.1 ENG-3.P.1 ENG-3.Q.1 ENG-3.R.1 ENG-3.S.1 ENG-3.T.1	

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		Describe the effects of the use of geothermal energy in power generation on the environment. Describe the use of hydrogen fuel cells in power generation. Describe the effects of the use of hydrogen fuel cells in power generation on the environment. Describe the use of wind energy in power generation. Describe the effects of the use of wind energy in power generation on the environment. Describe methods for conserving energy		ENG-3.T.2	
Atmospheric Pollution	Human activities have physical, chemical, and biological consequences for the atmosphere.	Identify the sources and effects of air pollutants. Explain the causes and effects of photochemical smog and methods to reduce it. Describe thermal inversion and its relationship with pollution. Describe natural sources of CO2 and particulates. Identify indoor air pollutants. Describe the effects of indoor air pollutants. Explain how air pollutants can be reduced at	Primary pollutant Secondary pollutant Photochemical smog Thermal inversion Particulates Indoor air pollution Acid rain Noise pollution	STB-2.A.1 STB-2.A.2 STB-2.A.3 STB-2.A.4 STB-2.A.5 STB-2.B.1 STB-2.B.2 STB-2.B.3 STB-2.B.4 STB-2.B.5 STB-2.B.6 STB-2.B.7 STB-2.C.1 STB-2.C.2 STB-2.D.1 STB-2.D.2 STB-2.E.1 STB-2.E.2 STB-2.E.3 STB-2.E.4 STB-2.E.5 STB-2.E.6 STB-2.E.7 STB-2.F.1	5 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		the source. Describe acid deposition. Describe the effects of acid deposition on the environment. Describe human activities that result in noise pollution and its effects.		STB-2.F.2 STB-2.G.1 STB-2.G.2 STB-2.G.3 STB-2.G.4 STB-2.G.5 STB-2.H.1 STB-2.H.2 STB-2.I.1 STB-2.I.2 STB-2.I.3 STB-2.J.1 STB-2.J.2 STB-2.J.3	
Aquatic and Terrestrial Pollution	Human activities, including the use of resources, have physical, chemical, and biological consequences for ecosystems. Pollutants can have both direct and indirect impacts on the health of organisms, including humans.	Identify differences between point and nonpoint sources of pollution. Describe the impacts of human activities on aquatic ecosystems. Describe endocrine disruptors. Describe the effects of endocrine disruptors on ecosystems. Describe the impacts of human activity on wetlands and mangroves. Explain the environmental effects of excessive use of fertilizers and detergents on aquatic ecosystems. Describe the effects of thermal pollution on aquatic ecosystems. Describe the effect of persistent organic pollutants (POPs) on ecosystems.	Endocrine disruptors Mangroves Eutrophication Wetlands Thermal pollution POPs Bioaccumulation Biomagnification Solid waste Sewage treatment LD-50 Dose response curve Pathogens Vectors	STB-3.A.1 STB-3.A.2 STB-3.B.1 STB-3.B.2 STB-3.B.3 STB-3.B.4 STB-3.B.5 STB-3.B.6 STB-3.B.7 STB-3.B.8 STB-3.B.9 STB-3.B.10 STB-3.C.1 STB-3.D.1 STB-3.E.1 STB-3.E.2 STB-3.E.3 STB-3.F.1 STB-3.F.2 STB-3.F.3 STB-3.F.4 STB-3.F.5 STB-3.G.1 STB-3.G.2 STB-3.H.1 STB-3.H.2 STB-3.H.3 STB-3.I.1 STB-3.I.2 STB-3.J.1 STB-3.J.2 STB-3.J.3 STB-3.K.1 STB-3.K.2	5 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		Describe bioaccumulation and biomagnification. Describe the effects of bioaccumulation and biomagnification. Describe solid waste disposal methods. Describe the effects of solid waste disposal methods. Describe changes to current practices that could reduce the amount of generated waste and their associated benefits and drawbacks. Describe best practices in sewage treatment. Define lethal dose 50% (LD50). Evaluate dose response curves. Identify sources of human health issues that are linked to pollution. Explain human pathogens and their cycling through the environment.		STB-3.K.3 STB-3.K.4 STB-3.L.1 STB-3.L.2 STB-3.L.3 STB-3.L.4 STB-3.M.1 STB-3.M.2 STB-3.M.3 STB-3.M.4 STB-3.M.5 STB-3.M.6 STB-3.N.1 STB-3.N.2 STB-3.N.3 STB-3.N.4 STB-3.N.4 EIN-3.A.1 EIN-3.B.1 EIN-3.C.1 EIN-3.C.2 EIN-3.C.3 EIN-3.C.4 EIN-3.D.1 EIN-3.D.2 EIN-3.D.4 EIN-3.D.5 EIN-3.D.6 EIN-3.D.7 EIN-3.D.8 EIN-3.D.9 EIN-3.D.10 EIN-3.D.11 EIN-3.D.12	
Global Change	Local and regional human activities can have impacts at the global level. The health of a species is closely tied to its ecosystem, and minor environmental changes	Explain the importance of stratospheric ozone to life on Earth. Describe chemicals used to substitute for chlorofluorocarbons (CFCs). Identify the greenhouse gases.	Stratospheric ozone Ozone depletion Greenhouse effect Ocean warming Ocean acidification Invasive species Endangered species	STB-4.A.1 STB-4.A.2 STB-4.A.3 STB-4.B.1 STB-4.C.1 STB-4.C.2 STB-4.C.3 STB-4.D.1 STB-4.E.1 STB-4.F.1	5 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	can have a large impact.	Identify the sources and potency of greenhouse gases. Identify the threats to human health and the environment posed by an increase in greenhouse gases. Explain how changes in climate, both short- and long term, impact ecosystems. Explain the causes and effects of ocean warming. Explain the causes and effects of ocean acidification. Explain the environmental problems associated with invasive species and strategies to control them. Explain how species become endangered and strategies to combat the problem. Explain how human activities affect biodiversity and strategies to combat the problem.		STB-4.F.2 STB-4.F.3 STB-4.F.4 STB-4.F.5 STB-4.F.6 STB-4.F.7 STB-4.F.8 STB-4.F.9 STB-4.F.10 STB-4.G.1 STB-4.G.2 STB-4.G.3 STB-4.H.1 STB-4.H.2 STB-4.H.3 STB-4.H.4 EIN-4.A.1 EIN-4.A.2 EIN-4.A.3 EIN-4.B.1 EIN-4.B.2 EIN-4.B.3 EIN-4.B.4 EIN-4.B.5 EIN-4.C.1 EIN-4.C.2 EIN-4.C.3 EIN-4.C.4 EIN-4.C.5 EIN-4.C.6	

Biology

Statement of Organization:
This course is a study of living organisms and their processes. Emphasis is placed on science process skills, problem solving and how biology affects the students' daily lives.

Expected Levels of Achievement:
Students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Lab reports
- Observation
- Presentations
- Projects
- Teacher-made tests

Estimated Instructional Time:
Biology is offered to students in grades nine through twelve who have successfully completed eighth grade physical science and meets for a minimum of one hundred twenty clock hours for one credit.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

- Chemical Basis of Life
- Cellular Structure and Function
- Bioenergetics
- Homeostasis & Transport
- Heredity & traits
- Evolution & natural Selection

Technology Integration:
In addition to print resources, students will use technology... (when, why, how???)

- Internet resources to research topics and gather information
- Vernier LabPro probes and software to gather and analyze data
- Excel to graph data and create data sets

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Assessment Anchors	Pacing
Structure and Function	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future	DNA RNA Genes Protein Protein Synthesis DNA replication transcription translation	3.1.9-12.A BIO.B.1.2.1 BIO.B.1.2.2 BIO.B.2.2.1 BIO.B.2.2.2	1st Marking Period
Structure and Function	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	unicellular multicellular prokaryotic eukaryotic tissue organ organ system organism stimuli circulatory system nutrient levels of biological organization model system	3.1.9-12.B BIO.A.1.1.1 BIO.A.1.2.2	1st Marking Period
Structure and Function	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly	homeostasis feedback loops stomate transpiration temperature regulation osmoregulation excretory system	3.1.9-12.C BIO.A.4.2.1 BIO.A.4.1.1 BIO.A.4.1.2	1st Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Assessment Anchors	Pacing
Growth and Development of Organisms	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.	Use a model based on evidence to illustrate the relationships between systems or between components of a system	mitosis gene expression multicellular differentiation tissue organ organ system organism input output system model	3.1.9-12.D BIO.B.1.1.1 BIO.B.1.1.2	2nd Marking Period
Organization for Matter and Energy Flow in Ecosystems	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.	Use a model based on evidence to illustrate the relationships between systems or between components of a system.	photosynthesis glucose input output reactant product chemical energy light energy	3.1.9-12.E BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2	2nd Marking Period
Organization for Matter and Energy Flow in Ecosystems	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbonbased molecules	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	organic molecules monomer polymer macromolecules protein hydrocarbon amino acid cellular respiration matter element metabolism	3.1.9-12.F BIO.A.2.2.1 BIO.A.2.2.2 BIO.A.2.2.3 BIO.A.2.3.2 BIO.A.2.3.1	2nd Marking Period
Organization for Matter and Energy Flow in Ecosystems	Use a model to illustrate that cellular respiration is a	Use a model based on evidence to illustrate the relationships between	mitochondria cellular respiration	3.1.9-12.G BIO.A.2.3.1	2nd Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Assessment Anchors	Pacing
	chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.	systems or between components of a system.	reactants products chemical energy stored energy input output food molecule net transfer ADP/ATP	BIO.A.2.3.2 BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2	
Cycles of Matter and Energy Flow in Ecosystems	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	anaerobic respiration aerobic respiration photosynthesis cellular respiration energy transfer	3.1.9-12.J BIO.A.3.2.1 BIO.A.3.2.2	2nd Marking Period
Cycles of Matter and Energy Flow in Ecosystems	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	Develop a model based on evidence to illustrate the relationships between systems or components of a system	carbon cycle photosynthesis cellular respiration carbon cycle biosphere atmosphere hydrosphere geosphere	3.1.9-12.K BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.2 BIO.B.4.2.3	2nd Marking Period
Inheritance of Traits	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.	Ask questions that arise from examining models or a theory to clarify relationships.	DNA gene allele chromosome gene expression protein traits inheritance	3.1.9-12.P BIO.B.1.2.2	3rd Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Assessment Anchors	Pacing
Variation in Traits	Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.	Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence	meiosis genetic mutation genetic variation	3.1.9-12.Q BIO.B.2.1.2 BIO.B.2.3.1 BIO.B.2.4.1	3rd Marking Period
Variation in Traits	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.	genotype phenotype inheritance traits gene expression population	3.1.9-12.R BIO.B.2.1.1 BIO.B.3.3.1	3rd Marking Period
Evidence of Common Ancestry and Diversity	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence	Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	evolution evolutionary evidence	3.1.9-12.S BIO.B.3.2.1 BIO.B.3.3.1	4th Marking Period
Natural Selection	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	natural selection evolution biological fitness genetic variation mutation competition	3.1.9-12.T BIO.B.3.1.1 BIO.B.3.3.1	4th Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Assessment Anchors	Pacing
	to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.				
Natural Selection	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait	Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.	natural selection evolution allele frequency biological fitness	3.1.9-12.U BIO.B.3.1.1 BIO.B.3.3.1	4th Marking Period
Adaptation	Create or revise a simulation to test a solution to mitigate the adverse impacts of human activity on biodiversity.	Simple computational simulations are created and used based on mathematical models of basic assumptions. Create or revise a simulation of a phenomenon, designed device, process, or system.	biodiversity speciation biological extinction human disturbances	3.1.9-12.V BIO.B.4.2.4 BIO.B.4.2.5	4th Marking Period
Adaptation	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that	Adaptation Biological fitness natural selection evolution	3.1.9-12.W BIO.B.3.2.1 BIO.B.3.3.1	4th Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Assessment Anchors	Pacing
		describe the natural world operate today as they did in the past and will continue to do so in the future			
Adaptation	Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.	Arguments may also come from current or historical episodes in science. Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.	Biodiversity species speciation extinction divergent evolution convergent evolution	3.1.9-12.X BIO.B.3.2.1 BIO.B.3.3.1	4th Marking Period

Honors Biology

Statement of Organization:
This course is a study of living organisms and their processes. Emphasis is placed on science process skills, problem solving and how biology affects the students' daily lives. Honors biology follows the same basic sequence and content as biology but includes a few extra enrichment topics.

Expected Levels of Achievement:
Students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Lab reports
- Observation
- Presentations
- Projects
- Teacher-made tests

Honors Biology involves more rigorous assessment than Biology

Estimated Instructional Time:
Biology is offered to students in grades nine through twelve who have successfully completed eighth grade physical science and meets for a minimum of one hundred twenty clock hours for one credit.

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

- Chemical Basis of Life
- Cellular Structure and Function
- Bioenergetics
- Homeostasis & Transport
- Heredity & traits
- Evolution & natural Selection

Technology Integration:
In addition to print resources, students will use technology... (when, why, how???)

- Internet resources to research topics and gather information
- Vernier LabPro probes and software to gather and analyze data
- Excel to graph data and create data sets

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Anchors	Anticipated Pacing
Structure and Function	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future	DNA RNA Genes Protein Protein Synthesis DNA replication Semiconservative replication DNA polymerase Ligase Okazaki fragments transcription translation	3.1.9-12.A BIO.B.1.2.1 BIO.B.1.2.2 BIO.B.2.2.1 BIO.B.2.2.2	1st Marking Period
Structure and Function	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	unicellular multicellular prokaryotic eukaryotic tissue organ organ system organism stimuli circulatory system nutrient levels of biological organization model system	3.1.9-12.B BIO.A.1.1.1 BIO.A.1.2.2	1st Marking Period
Structure and Function	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable	homeostasis feedback loops stomate transpiration temperature regulation	3.1.9-12.C BIO.A.4.2.1 BIO.A.4.1.1 BIO.A.4.1.2	1st Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Anchors	Anticipated Pacing
		measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly	osmoregulation excretory system passive transport facilitated diffusion hypotonic hypertonic active transport vesicular transport		
Growth and Development of Organisms	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.	Use a model based on evidence to illustrate the relationships between systems or between components of a system	mitosis gene expression multicellular differentiation tissue organ organ system organism input output system model	3.1.9-12.D BIO.B.1.1.1 BIO.B.1.1.2	2nd Marking Period
Organization for Matter and Energy Flow in Ecosystems	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.	Use a model based on evidence to illustrate the relationships between systems or between components of a system.	photosynthesis Calvin cycle Light reactions glucose input output reactant product chemical energy light energy	3.1.9-12.E BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2	2nd Marking Period
Organization for Matter and Energy Flow in Ecosystems	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations,	organic molecules monomer polymer macromolecules	3.1.9-12.F BIO.A.2.2.1 BIO.A.2.2.2 BIO.A.2.2.3	2nd Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Anchors	Anticipated Pacing
	sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules	models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	functional group dehydration synthesis hydrolysis protein hydrocarbon amino acid cellular respiration matter element metabolism	BIO.A.2.3.2 BIO.A.2.3.1	
Organization for Matter and Energy Flow in Ecosystems	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.	Use a model based on evidence to illustrate the relationships between systems or between components of a system.	mitochondria cellular respiration reactants products chemical energy stored energy input output food molecule net transfer ADP/ATP Chemiosmosis Substrate-level phosphorylation Redox reactions	3.1.9-12.G BIO.A.2.3.1 BIO.A.2.3.2 BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2	2nd Marking Period
Cycles of Matter and Energy Flow in Ecosystems	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	anaerobic respiration aerobic respiration photosynthesis cellular respiration energy transfer glycolysis Krebs cycle Electron transport chain	3.1.9-12.J BIO.A.3.2.1 BIO.A.3.2.2	2nd Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Anchors	Anticipated Pacing
Cycles of Matter and Energy Flow in Ecosystems	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	Develop a model based on evidence to illustrate the relationships between systems or components of a system	carbon cycle photosynthesis cellular respiration carbon cycle biosphere atmosphere hydrosphere geosphere	3.1.9-12.K BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.2 BIO.B.4.2.3	2nd Marking Period
Inheritance of Traits	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.	Ask questions that arise from examining models or a theory to clarify relationships.	DNA gene allele chromosome chromatin histones gene expression protein traits inheritance	3.1.9-12.P BIO.B.1.2.2	3rd Marking Period
Variation in Traits	Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.	Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence	Meiosis Synapsis Tetrad Crossing over genetic mutation genetic variation	3.1.9-12.Q BIO.B.2.1.2 BIO.B.2.3.1 BIO.B.2.4.1	3rd Marking Period
Variation in Traits	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.	genotype phenotype inheritance traits gene expression population	3.1.9-12.R BIO.B.2.1.1 BIO.B.3.3.1	3rd Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Anchors	Anticipated Pacing
Evidence of Common Ancestry and Diversity	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence	Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	evolution evolutionary evidence vestigial organs radioactive dating	3.1.9-12.S BIO.B.3.2.1 BIO.B.3.3.1	4th Marking Period
Natural Selection	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	natural selection evolution biological fitness genetic variation mutation inversion deletion substitution competition	3.1.9-12.T BIO.B.3.1.1 BIO.B.3.3.1	4th Marking Period
Natural Selection	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait	Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific	natural selection evolution allele frequency Hardy-Weinberg equilibrium biological fitness	3.1.9-12.U BIO.B.3.1.1 BIO.B.3.3.1	4th Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards/ Anchors	Anticipated Pacing
		and engineering questions and problems, using digital tools when feasible.			
Adaptation	Create or revise a simulation to test a solution to mitigate the adverse impacts of human activity on biodiversity.	Simple computational simulations are created and used based on mathematical models of basic assumptions. Create or revise a simulation of a phenomenon, designed device, process, or system.	biodiversity speciation allopatric sympatric biological extinction human disturbances	3.1.9-12.V BIO.B.4.2.4 BIO.B.4.2.5	4th Marking Period
Adaptation	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future	Adaptation Biological fitness natural selection evolution	3.1.9-12.W BIO.B.3.2.1 BIO.B.3.3.1	4th Marking Period
Adaptation	Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.	Arguments may also come from current or historical episodes in science. Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.	Biodiversity species speciation extinction divergent evolution convergent evolution	3.1.9-12.X BIO.B.3.2.1 BIO.B.3.3.1	4th Marking Period

College in High School
Concepts of Biology BIOL 0091

Course Description

A survey of biological concepts providing students with a good understanding of how biology relates to everyday life.

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

- Describe how human traits' heritability follows Mendelian patterns of inheritance
- Explain how laws of probability influence inheritance of traits
- Distinguish between eukaryotic and prokaryotic cells
- Explain the role of mitochondria and chloroplasts in cells' energy production and transformation

Student Learning Outcomes

- Describe the structural and functional adaptations that contribute to success of prokaryotes
- Explain how rapid reproduction, mutation and genetic recombination promote genetic diversity in prokaryotes
- Describe the beneficial and harmful impacts prokaryotes have on human life
- Compare characteristics of red and green algae and how they are the closest relatives of terrestrial plants
- Identify and describe the roles that many protists play in ecological communities
- Explain the evolution of terrestrial plants from green algae ancestors
- Distinguish between gametophyte and sporophyte stages of moss and fern life cycles
- Differentiate between vascular and non-vascular plants that produce seeds and spores during their life cycles
- Explain the importance of pollen grains and seed production to the advancement of terrestrial plants
- Distinguish between the seed production of gymnosperms and angiosperms
- Describe the reproductive advantages of angiosperms producing flowers and fruits and their impact on human welfare
- Identify fungal features that contribute to their heterotrophic feeding style
- Explain the key roles fungi play in nutrient cycling, ecological relationships and human welfare
- Identify animals as multicellular, heterotrophic eukaryotes with tissues developed from embryonic layers
- Describe the pattern between an animal's early embryonic development and its final body plan or style
- Explain the connection between early embryonic development and stem cell research

- Describe the evolutionary relationships between phyla of invertebrates
- Describe the physical similarities and unique qualities of invertebrates such as earthworms, grasshoppers, and crayfish
- Describe the evolutionary relationships between phyla of vertebrates
- Describe the physical similarities and unique qualities of vertebrates such as frogs and pigs

Required Texts and Materials

Textbook: Campbell Biology; Urry, Cain, Wasserman, Minorsky and Orr; 12th edition; 2021
Website: www.masteringbiology.com

TOPICS:
Unit #1 – Analysis of Kingdoms Monera & Protista
Ch. 27 – Prokaryotes and the Origins of Metabolic Diversity
Ch. 28 – Origins of Eukaryotic Diversity
Unit #2 – Plant Diversity & Evolution
Ch. 29 – Plant Diversity I: How Plants Colonized Land
Ch. 30 – Plant Diversity II: Evolution of Seed Plants
Unit #3 – Evolutionary History of Biological Diversity
Ch. 31 - Fungi
Ch. 32 – Introduction to Animal Evolution
Ch. 33 - Invertebrates
Ch. 34 – Vertebrate Evolution & Diversity
Unit #4 – Genetics & Cells
Ch. 14 – Mendel & the Gene Idea
Ch. 6 – Tour of the Cell

Physical Science I

Statement of Organization:
This course is an introduction to Chemistry. An emphasis is placed on preparing students for developing process and problem-solving skills as well as creating experiences with laboratory techniques and equipment.

Expected Levels of Achievement:
All students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Exams
- Quizzes
- Homework
- Research projects
- Lab experiments
- Performance assessments

Estimated Instructional Time:
120 clock hours

Technology Integration:
In addition to print resources, students will use technology such as Internet research and tutorial resources

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
The atoms of some substances combine or rearrange to form new substances that have different properties.	How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?	Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.	collision theory chemical reactions reaction rate reactants solutions temperature concentration solubility patterns scientific principles	**3.2.9-12.E** Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.	5 weeks
All forms of matter exist as a result of the combination or rearrangement of atoms.	How do particles combine to form the variety of matter one observes?	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	reactants products types of bonds types of reactions reactivity patterns	**3.2.9-12.C** Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	4 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
All forms of matter exist as a result of the combination or rearrangement of atoms.	How do particles combine to form the variety of matter one observes?	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	intermolecular forces ions physical properties coulomb's law Lewis dot structures lattice energy patterns	**3.2.9-12.B** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.	4 weeks
All forms of matter exist as a result of the combination or rearrangement of atoms.	How do particles combine to form the variety of matter one observes?	Use a model to predict the relationships between systems or between components of a system.	proton neutron electron atomic number mass number isotope electron affinity shielding effect electronegativity atomic radius ionization energy valence electrons electron shells orbital diagrams periodic table patterns	**3.2.9-12.A** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms	5 weeks
All forms of matter exist as a result of the combination or rearrangement of atoms.	How do particles combine to form the variety of matter one observes?	Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	energy transfers types of energy bond and binding energy models	**3.2.9-12.D** Develop a model to illustrate that the release or	4 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
			systems	absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	
The atoms of some substances combine or rearrange to form new substances that have different properties.	How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?	Use mathematical representations of phenomena to support claims	molar mass balancing equations stoichiometry law of conservation matter nuclear processes	**3.2.9-12.G** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	5 weeks
Phenomena involving nuclei explain the formation of the elements, radioactivity, and the release of energy.	What forces hold nuclei together and mediate nuclear processes?	Develop a model based on evidence to illustrate the relationships between systems or between components of a system.	isotopes nuclear fission radioactive decay stable nuclei unstable nuclei half-life types of radiation (alpha, beta, gamma) nuclear fusion models	**3.2.9-12.H** Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.	5 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
The atoms of some substances combine or rearrange to form new substances that have different properties.	How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?	Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations.	equilibrium percent yield Le Chatelier's Principle design	**3.2.9-12.F** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	4 weeks

Physical Science II

Statement of Organization:
This course is an introduction to Physics. An emphasis is placed on preparing students for developing process and problem-solving skills as well as creating experiences with laboratory techniques and equipment.

Expected Levels of Achievement:
All students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Exams
- Quizzes
- Homework
- Research projects
- Lab experiments
- Performance assessments

Estimated Instructional Time:
120 clock hours

Technology Integration:
In addition to print resources, students will use technology such as Internet research and tutorial resources.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
A change in motion of interacting objects can be explained and predicted by forces.	How can one predict an object's continued motion, changes in motion, or stability?	Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.	force system speed velocity acceleration mass net force vector scalar magnitude causality cause and effect	**3.2.9-12.I** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.	2 weeks
A change in motion of interacting objects can be explained and predicted by forces.	How can one predict an object's continued motion, changes in motion, or stability?	Use mathematical representations of phenomena to describe explanations.	momentum impulse force conservation net force elastic collision inelastic collision	**3.2.9-12.J** Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system	2 weeks
A change in motion of interacting objects can be explained and predicted by forces.	How can one predict an object's continued motion, changes in motion, or stability?	Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.	force time impulse momentum collision acceleration design	**3.2.9-12.K** Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision.	3 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
All forces between objects, regardless of size or direction, arise from only a few types of interactions.	What underlying forces explain the variety of interactions observed?	Use mathematical representations of phenomena to describe explanations.	gravitational force newton's law of gravitation Coulomb's Law electric force inverse square law field patterns	**3.2.9-12.L** Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.	2 weeks
All forces between objects, regardless of size or direction, arise from only a few types of interactions.	What underlying forces explain the variety of interactions observed?	Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	molecular structure conductivity polarity state of matter friction	**3.2.9-12.N** Communicate scientific and technical information about why molecular-level structure is important in functioning of designed materials.	3 weeks
Energy can be modeled as either motions of particles or as being stored in force fields.	What is energy?	Create a computational model or simulation of a phenomenon, designed device, process, or system.	kinetic energy mechanical energy potential energy energy transfer system conservation of energy first law of thermodynamics system models basic laws	**3.2.9-12.O** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows are known.	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Energy can be modeled as either motions of particles or as being stored in force fields.	What is energy?	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	energy kinetic energy potential energy conservation of energy first law of thermodynamics models	**3.2.9-12.P** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).	2 weeks
Energy can be modeled as either motions of particles or as being stored in force fields.	What is energy?	Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	energy conservation of energy energy transfer mechanical energy kinetic energy potential energy technological systems	**3.2.9-12Q** Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	2 weeks
Waves are repeating patterns of motion that transfer energy and information without transferring matter.	What are the characteristic properties and behaviors of waves?	Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations	medium frequency wave wavelength longitudinal wave transverse wave wave speed	**3.2.9-12T** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media	3 weeks
The total change of energy in any system is always	What is meant by conservation of energy?	Plan and conduct an investigation individually and collaboratively to	second law of thermodynamics	**3.2.9-12R** Plan and conduct	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
equal to the total energy transferred into or out of the system.	How is energy transferred between objects or systems?	produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	thermal energy heat heat transfer systems closed system system models	an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	
Forces between objects can result in transfer of energy between these objects.	How are forces related to energy?	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	Coulomb's Law Lorentz force law field force	**3.2.9-12S** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	2 weeks
Waves are repeating patterns of motion that transfer energy and information without transferring matter.	What are the characteristic properties and behaviors of waves?	Evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.	digital transmission information storage wave behavior	**3.2.9-12U** Evaluate questions about the advantages of using digital transmission	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
			technological systems	and storage of information.	
Waves are repeating patterns of motion that transfer energy and information without transferring matter.	What are the characteristic properties and behaviors of waves?	Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.	electromagnetic radiation wave model of radiation particle model of radiation photon system models	**3.2.9-12V** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model and that for some situations one model is more useful than the other.	2 weeks
Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave pattern of changing electric and magnetic fields that interact with matter.	What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?	Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible.	electromagnetic wave wavelength frequency wave energy wave absorption systems	**3.2.9-12W** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.	3 weeks
All forces between objects, regardless of size or direction, arise from only a few types of interactions.	What underlying forces explain the variety of interactions observed?	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on	electric current field circuit	**3.2.9-12.M** Plan and conduct investigation to provide evidence	2 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.		that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.	
Useful modern technologies and instruments have been designed based on an understanding of waves and their interactions with matter.	How are instruments that transmit and detect waves used to extend human senses?	Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).	digital transmission wave interference systems technological devices systems	**3.2.9-12X** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	2 weeks

Chemistry I

Statement of Organization:
This course is designed to induce general chemistry concepts which focuses on the quantitative and qualitative study of the structure, properties, and interactions of matter.

Expected Levels of Achievement:
Students are expected to master the objectives taught by achieving at least eighty percent (80%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Tests
- Quizzes
- Projects
- Lab Reports
- Homework

Estimated Instructional Time:
120 clock hours (1 school year)

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with the standards, such as online chemical modelling tools, molecular simulations, and laboratory technology.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Structure and Properties of Matter	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (3.2.9-12.B).	Students should be able to plan and conduct an investigation to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles and discuss how this affects their properties.	Intermolecular Forces Physical Properties	3.2.9-12.B	Quarter 1
Structure and Properties of Matter	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy (3.2.9-12.D).	Develop a model based on evidence to illustrate the relationships between systems or between components of a system to characterize transfer of energy between particles in a system when collisions occur.	Systems Model Types of Energy Energy Transfer Binding Energy	3.2.9-12.D	Quarter 1
Chemical Reactions	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs (3.2.9-12.E).	Apply scientific principles and evidence to provide an explanation of collision-based phenomena.	Collision Theory Chemical Reactions Reactants Temperature	3.2.9-12.E	Quarter 1
Definitions of Energy	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects) (3.2.9-12.P).	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system as it relates to molecular collisions where energy is transferred.	Energy Kinetic Energy Potential Energy Conservation of Energy First Law of Thermodynamics Models	3.2.9-12.P	Quarter 1
Definitions of Energy	Create a computational model to calculate the	Create a computational model or simulation of a phenomenon, designed	Kinetic Energy Energy Transfer	3.2.9-12.O	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known (3.2.9-12.O).	device, process, or system during a process where energy is transferred.	System Conservation of Energy First Law of Thermodynamics System Models Basic Laws		
Conservation of Energy and Energy Transfer	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics) (3.2.9-12.R).	Plan and conduct an investigation on thermal equilibrium individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	Second Law of Thermodynamics Thermal Energy Heat Heat Transfer Systems Closed System System Models	3.2.9-12.R	Quarter 1
Structure and Properties of Matter	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms (3.2.9-12.A).	Students should be able to use a periodic model to predict the relationships components of an atomic system.	Periodic Table Proton Neutron Electron Atomic Number Mass Number Isotope	3.2.9-12.A	Quarter 1
Structure and Properties of Matter	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (3.2.9-12.B).	Students should be able to plan and conduct an investigation to compare the structure of substances at the bulk scale to infer the strength of electrical forces within a particle or system.	Ions	3.2.9-12.B	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Nuclear Processes	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay (3.2.9-12.H).	Develop a model based on evidence to illustrate the relationships between systems or between components of a system during a nuclear process.	Isotopes Nuclear Fission Radioactive Decay Stable/Unstable Nuclei Half-Life Types of Radiation (Alpha, Beta, Gamma) Nuclear Fusion Models	3.2.9-12.H	Quarter 1
Chemical Reactions	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction (3.2.9-12.G).	Use mathematical representations of phenomena to support claims that mass is conserved during nuclear processes.	Law of Conservation of Matter Nuclear Processes	3.2.9-12.G	Quarter 1
Structure and Properties of Matter	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy (3.2.9-12.D).	Develop a model based on evidence to illustrate the relationships between systems or between components of a system to show how chemical processes can transfer energy.	Systems Types of Energy Energy Transfer Binding Energy Bond Energy	3.2.9-12.D	Quarter 2
Definitions of Energy	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known (3.2.9-12.O).	Create a computational model or simulation of a phenomenon, designed device, process, or system during a process where energy is transferred.	Energy Transfer System Conservation of Energy First Law of Thermodynamics System Models Basic Laws	3.2.9-12.O	Quarter 2
Definitions of Energy	Create a computational model to calculate the change in the energy of one	Create a computational model or simulation of a phenomenon, designed device, process, or system during a	Kinetic Energy Energy Transfer System	3.2.9-12.O	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known (3.2.9-12.O).	process where energy is transferred.	Conservation of Energy First Law of Thermodynamics System Models Basic Laws		
Wave Properties	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media (3.2.9-12.T).	Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations about electromagnetic waves.	Medium Frequency Wave Wavelength Longitudinal Wave Transverse Wave Wave Speed	3.2.9-12.T	Quarter 2
Wave Properties	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model and that for some situations one model is more useful than the other (3.2.9-12.V).	Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments about the wave and particle models of electromagnetic radiation.	Electromagnetic Radiation Wave Model of Radiation Particle Model of Radiation Photon System Model	3.2.9-12.V	Quarter 2
Wave Properties	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter (3.2.9-12.W).	Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data about electromagnetic radiation.	Electromagnetic Wave Wavelength Frequency Wave Energy Wave Absorption Systems	3.2.9-12.W	Quarter 2
Structure and Properties of Matter	Use the periodic table as a model to predict the relative properties of elements based	Students should be able to use a periodic model and patterns to predict the relationships between systems or	Valence Electrons Electron Shells Orbital Diagrams	3.2.9-12.A	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	on the patterns of electrons in the outermost energy level of atoms (3.2.9-12.A).	between components of an atomic system.	Electron Configuration Orbitals Sublevels		
Structure and Properties of Matter	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (3.2.9-12.B).	Students should be able to plan and conduct an investigation to compare the structure of substances at the bulk scale and discuss how this affects their properties.	Lewis Dot Structures Patterns	3.2.9-12.B	Quarter 2
Structure and Properties of Matter	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms (3.2.9-12.A).	Students should be able to use a periodic model and patterns to predict the relationships between systems or between components of an atomic system.	Patterns Electron Affinity Shielding Effect Electronegativity Atomic Radius Ionization Energy Valence Electrons Octet Rule	3.2.9-12.A	Quarter 2
Structure and Properties of Matter	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (3.2.9-12.B).	Students should be able to plan and conduct an investigation to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles and discuss how this affects their properties.	Ions Coulomb's Law	3.2.9-12.B	Quarter 2
Structure and Properties of Matter	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that	Reactivity Patterns	3.2.9-12.C	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	table, and knowledge of the patterns of chemical properties (3.2.9-12.C).	theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future to describe chemical properties and reactions.			
Structure and Properties of Matter	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (3.2.9-12.B).	Students should be able to plan and conduct an investigation to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles and discuss how this affects their properties.	Lattice Energy Ions Coulomb's Law Physical Properties	3.2.9-12.B	Quarter 3
Structure and Properties of Matter	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties (3.2.9-12.C).	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future to describe chemical properties, bonding, and reactions.	Types of Bonds Reactivity Pattern	3.2.9-12.C	Quarter 3
Types of Interactions	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current (3.2.9-12.M).	Plan and conduct an investigation on electrical conductivity of ionic compounds individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time),	Electric Current Field Circuit	3.2.9-12.M	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		and refine the design accordingly.			
Types of Interactions	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials (3.2.9-12.N).	Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically) about importance of molecular structure and function of materials as it relates to ionic compounds.	Molecular Structure Conductivity Polarity State of Matter	3.2.9-12.N	Quarter 3
Structure and Properties of Matter	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (3.2.9-12.B).	Students should be able to plan and conduct an investigation to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles and discuss how this affects their properties.	Coulomb's Law Physical Properties	3.2.9-12.B	Quarter 3
Structure and Properties of Matter	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties (3.2.9-12.C).	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future to describe chemical bonding, properties, and reactions.	Types of Bonds Reactivity Pattern	3.2.9-12.C	Quarter 3
Types of Interactions	Plan and conduct an investigation to provide evidence that an electric	Plan and conduct an investigation on electrical conductivity of various materials individually and	Electric Current Field Circuit	3.2.9-12.M	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	current can produce a magnetic field and that a changing magnetic field can produce an electric current (3.2.9-12.M).	collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.			
Types of Interactions	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials (3.2.9-12.N).	Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically) about importance of molecular structure and function of materials.	Molecular Structure Conductivity Polarity State of Matter	3.2.9-12.N	Quarter 3
Structure and Properties of Matter	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties (3.2.9-12.C).	Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future to describe chemical bonding and reactions.	Reactants Products Types of Reactions	3.2.9-12.C	Quarter 4
Chemical Reactions	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction (3.2.9-12.G).	Use mathematical representations of phenomena to support claims that mass is conserved during chemical reactions.	Balancing Equations Law of Conservation of Matter	3.2.9-12.G	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Structure and Properties of Matter	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy (3.2.9-12.D).	Develop a model based on evidence to illustrate the relationships between systems or between components of a system to show how chemical processes can transfer energy.	Systems Types of Energy Energy Transfer Binding Energy Bond Energy	3.2.9-12.D	Quarter 4
Chemical Reactions	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs (3.2.9-12.E).	Apply scientific principles and evidence to provide an explanation of reaction phenomena.	Collision Theory Chemical Reactions Reaction Rate Reactants Solutions Temperature Concentration Solubility Patterns Scientific Principles	3.2.9-12.E	Quarter 4
Chemical Reactions	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction (3.2.9-12.G).	Use mathematical representations of phenomena to support claims that mass is conserved during chemical reactions.	Balancing Equations Law of Conservation of Matter Molar Mass Stoichiometry	3.2.9-12.G	Quarter 4
Chemical Reactions	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium (3.2.9-12.F).	Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations relating to percent yield.	Percent Yield Design	3.2.9-12.F	Quarter 4
Chemical Reactions	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the	Apply scientific principles and evidence to provide an explanation of reaction phenomena in solutions.	Collision Theory Chemical Reactions Reaction Rate Reactants Solutions	3.2.9-12.E	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	reacting particles on the rate at which a reaction occurs (3.2.9-12.E).		Temperature Concentration Solubility Patterns Scientific Principles		
Chemical Reactions	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium (3.2.9-12.F).	Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations about amounts of products during a reaction where its equilibrium plays a role.	Equilibrium Percent Yield Le Chatelier's Principle Design	3.2.9-12.F	Quarter 4

AP Chemistry

Statement of Organization:
This course is designed to deepen and extend students' knowledge of college-level chemistry principles and concepts after successful completion of a general inorganic chemistry course. This course is structured in alignment with the College Board's AP Chemistry curriculum as outlined in the AP Chemistry Course and Exam Description. The course focuses on the main, broad topics: atomic structure and properties, compound structure and properties, properties of substances and mixtures, chemical reactions, kinetics, thermochemistry, equilibrium, acids and bases, thermodynamics and electrochemistry while developing skills important to the science practices outlined below.

The course as described by College Board, "The AP Chemistry course outlined in this framework reflects what chemistry teachers, professors, and researchers have agreed is the main goal of a college-level general chemistry course: to help students develop a robust conceptual understanding of chemical principles that can be applied to future coursework and phenomena. The course is designed to enable students to view chemical phenomena through a variety of conceptual lenses, and at various levels: macroscopic, microscopic, sub-microscopic, and symbolic. Throughout the course, students learn to apply a variety of science practices, such as describing, interpreting, and analyzing models; designing experiments and analyzing data; creating representations of data and chemical systems; using mathematical routines to solve problems; and providing evidence and reasoning to justify a scientific claim."

AP Chemistry Course and Exam Description: https://apcentral.collegeboard.org/media/pdf/ap-chemistry-course-and-exam-description.pdf

Expected Levels of Achievement:
Students are expected to master the objectives taught by achieving at least eighty percent (80%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Practice AP Exams
- Exams
- Quizzes
- Projects
- Lab Reports
- Research Assignments
- Homework

Estimated Instructional Time:
240 clock hours (1 school year, double block course)

Sequence

The Big Ideas/Reporting Categories are listed in order of delivery, following the chapters outlined in the course text: Zumdahl, Steven S., et. Al., Chemistry, 7th Edition. Boston, New York, Houghton Mifflin Company, 2007. The chapters cover the nine AP Chemistry units as outlined by the College Board:

Unit 1: Atomic Structure and Properties
Unit 2: Compound Structure and Properties
Unit 3: Properties of Substances and Mixtures
Unit 4: Chemical Reactions
Unit 5: Kinetics
Unit 6: Thermochemistry
Unit 7: Equilibrium
Unit 8: Acids and Bases
Unit 9: Thermodynamics and Electrochemistry

Additional materials are provided for topics in the AP Chemistry curriculum that are excluded from the course text.
Time is reserved for review before the AP Exam. Projects within the scope of the course are completed after the AP Exam.

Technology Integration:

In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with the standards, such as use of approved websites for research projects, online chemical modelling tools, and online molecular simulations. Video resources, practice problems, and practice exams are and can be assigned in AP Classroom.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 1 and 2: Chemical Foundations and Particles	Calculate quantities of a substance or its relative number of particles using dimensional analysis and the mole concept (1.1.A).	Apply knowledge that particles cannot be directly counted while performing laboratory work by using the connection between the masses of substances reacting and the actual number of particles undergoing chemical changes (1.1.A.1-3).	Particles, Mass, Molar Mass, Moles, Atoms, Molecules, Ions, Compound, Formula Units, Grams, Avogadro's Number, Average Atomic Mass, Atomic Mass Units (amu)	1.1.A.1, 1.1.A.2, 1.1.A.3	Quarter 1
Chapter 1 and 2: Chemical Foundations and Particles	Explain the quantitative relationship between the mass spectrum of an element and the masses of the element's isotopes (1.2.A).	Evaluate the mass spectrum of a sample containing a single element to determine the identity of the isotopes of that element and the relative abundance of each isotope in nature. Relate this to the average atomic mass of an element by taking a weighted average of the isotopic masses to identify the element (1.2.A.1-2).	Mass Spectrum, Isotope, Relative Abundance, Proton, Neutron, Electron, Mass Number	1.2.A.1, 1.2.A.2	Quarter 1
Chapter 1 and 2: Chemical Foundations and Particles	Explain the quantitative relationship between the elemental composition by mass and the empirical formula of a pure substance (1.3.A).	Identify structural differences of pure substances as some are composed of individual molecules, while others consist of atoms or ions held together in fixed proportions as described by a formula unit. Apply the law of definite proportions to determine the ratio of the masses of the constituent elements in any pure sample and use this to determine a pure substance's empirical formulas (1.3.A.1-3).	Composition, Pure Substance, Empirical Formula, Law of Definite Proportions	1.3.A.1, 1.3.A.2, 1.3.A.3	Quarter 1
Chapter 1 and 2: Chemical Foundations and Particles	Explain the quantitative relationship between the elemental composition by mass and the composition of substances in a mixture (1.4.A).	Identify the composition differences between pure substances and mixtures. Use elemental analysis to determine the relative numbers of atoms in a substance and to determine its purity (1.4.A.1-2).	Purity, Gravimetric Analysis, Mixture,	1.4.A.1, 1.4.A.2	Quarter 1
Chapter 1 and 2: Chemical Foundations and Particles	Calculate the number of solute particles, volume, or molarity of solutions (3.7.A).	Recall that solutions can be solid, liquid, or gaseous. Differentiate between the composition of homogenous and heterogenous mixtures (3.7.A.1).	Homogenous, Heterogeneous, Solution	3.7.A.1	Quarter 1
Chapter 1 and 2: Chemical Foundations and Particles	Identify evidence of chemical and physical changes in matter (4.1.A).	Differentiate between physical and chemical changes based on the differences in their chemical composition. Recall that common physical changes are phase changes. Identify common chemical change indicators such as production of heat or light, formation of a gas, formation of a precipitate, and/or color change (4.1.A.1-2).	Physical Change, Chemical Change, Phase Change, Sublimation, Deposition, Condensation, Evaporation, Melting, Boiling, Indicator	4.1.A.1, 4.1.A.2	Quarter 1
Chapters 1 and 2: Chemical Foundations and Particles	Explain the results of a separation experiment based on intermolecular interactions (3.9.A).	Identify how separation of mixture techniques (filtration, chromatography, distillation) separate various types of mixtures (3.9.A.1).	Filtration, Chromatography, Stationary Phase, Mobile Phase, Distillation	3.9.A.1	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 1 and 2: Chemical Foundations and Particles	Explain the relationship between trends in the reactivity of elements and periodicity (1.8.A).	Determine the type of chemical bond formed by two elements and their possible formulas based on their location on the periodic table (1.8.A.1-3).	Chemical Bond, Periodicity, Ionic, Covalent	1.8.A.1, 1.8.A.2, 1.8.A.3	Quarter 1
Chapter 1 and 2: Chemical Foundations and Particles	Explain the relationship between macroscopic characteristics and bond interactions for: i. Chemical processes. ii. Physical processes (4.4.A).	Describe the difference in physical and chemical processes based on the changes in chemical bonds. Discuss how there are exceptions to types of processes and changes to bonds (4.4.A.1-2).		4.4.A.1, 4.4.A.2	Quarter 1
Chapter 3: Stoichiometry	Represent changes in matter with a balanced chemical or net ionic equation: i. For physical changes. ii. For given information about the identity of the reactants and/or product. iii. For ions in a given chemical reaction (4.2.A).	Represent physical and chemical processes with balanced equations. Understand that chemical changes are the result of a rearrangement of atoms into new combinations; thus, any representation of a chemical change must contain equal numbers of atoms of every element before and after the change occurred, demonstrating that mass and charge are conserved (4.2.A.1-2).	Reaction, Reactant, Product, Balanced, Law of Conservation Mass	4.2.A.1, 4.2.A.2	Quarter 1
Chapter 3: Stoichiometry	Represent a given chemical reaction or physical process with a consistent particulate model (4.3.A).	Represent balanced chemical equations in their various forms in symbolic particulate representations (4.3.A.1).		4.3.A.1	Quarter 1
Chapter 3: Stoichiometry	Explain changes in the amounts of reactants and products based on the balanced reaction equation for a chemical process (4.5.A).	Calculate product amounts by using known reactant amounts, or to calculate reactant amounts given known product amounts, based on the proportionality of moles of reactants and products in the balanced chemical equations (4.5.A.1-2). 4.5.A.3 Stoichiometric calculations can be combined with the ideal gas law and calculations involving molarity to quantitatively study gases and solutions	Stoichiometry, Mole Ratio	4.5.A.1, 4.5.A.2	Quarter 1
Chapter 4: Solution Stoichiometry	Calculate the number of solute particles, volume, or molarity of solutions (3.7.A).	Characterize the composition of a homogenous solution using molarity (3.7.A.2).	Molarity, Concentration, Concentrated, Dilute	3.7.A.2	Quarter 1
Chapter 4: Solution Stoichiometry	Using particulate models for mixtures: i. Represent interactions between components. ii. Represent concentrations of components (3.8.A).	Represent solutions in particulate diagrams to communicate the structure and properties of solutions, by illustration of the relative concentrations of the components in the solution and/or drawings that show interactions among the components (3.8.A.1).		3.8.A.1	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 4: Solution Stoichiometry	Represent changes in matter with a balanced chemical or net ionic equation: v. For physical changes. v. For given information about the identity of the reactants and/or product. i. For ions in a given chemical reaction (4.2.A).	Represent aqueous physical and chemical processes with balanced net ionic equations, which is most representative of their composition (4.2.A.3).	Net Ionic Equation, Complete Ionic Equation	4.2.A.3	Quarter 1
Chapter 4: Solution Stoichiometry	Explain changes in the amounts of reactants and products based on the balanced reaction equation for a chemical process (4.5.A).	Calculate product amounts by using known reactant amounts, or to calculate reactant amounts given known product amounts, based on the proportionality of moles of reactants and products in the balanced chemical equations in solutions, which is most accurately done through molarity (4.5.A.3).		4.5.A.3	Quarter 1
Chapter 4: Solution Stoichiometry	Identify the equivalence point in a titration based on the amounts of the titrant and analyte, assuming the titration reaction goes to completion (4.6.A).	Determine the amount of an analyte in solution by titration. Use the equivalence point of the titration to quantify when the analyte is totally consumed by the reacting species in the titrant which is often indicated by a change in a property (such as color) that occurs when the equivalence point is reached to make it observable (4.6.A.1).	Titration, Analyte, Titrant, Equivalence Point, End Point	4.6.A.1	Quarter 1
Chapter 4: Solution Stoichiometry	Identify a reaction as acid-base,oxidation-reduction, orprecipitation (4.7.A).	Identify acid-base, redox, and precipitation reactions based on their characteristics. Recall that acid-base reactions are characterized by a transfer of H^+ from an acid to a base, redox reactions are characterized by a transfer of electrons from a species that is reduced to a species that is oxidized which can be identified by a change in oxidation number, and precipitation reactions are characterized by the formation of an insoluble precipitate (4.7.A.1-5).	Acid-Base Reaction, Acid, Base, Oxidation-Reduction Reaction (Redox), Reduction, Oxidation, Oxidation Number, Precipitation, Precipitate, Solubility, Insoluble, Soluble	4.7.A.1, 4.7.A.2, 4.7.A.3, 4.7.A.4, 4.7.A.5	Quarter 1
Chapter 4: Solution Stoichiometry	Represent a balanced redox reaction equation using half-reactions (4.9.A).	Balance chemical equations for redox reactions from half-reactions (4.9.A.1).	Half-Reactions	4.9.A.1	Quarter 1
Chapter 5: Gas Laws	Explain the relationship between the macroscopic properties of a sample of gas or mixture of gases using the ideal gas law (3.4.A).	Calculate and determine the relationship between the macroscopic properties of ideal gases by the ideal gas law, including in graphical representations. Relate the properties of a mixed sample of ideal gases to the individual properties of	Ideal Gas, Ideal Gas Law, Pressure, Dalton's Law of Partial Pressure, Mole Fraction, Partial Pressure	3.4.A.1, 3.4.A.2, 3.4.A.3	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		each gas, such as partial pressure, which is proportional to the amount of each gas present in the sample (mole fraction) (3.4.A.1-3).			
Chapter 5: Gas Laws	Explain changes in the amounts of reactants and products based on the balanced reaction equation for a chemical process (4.5.A).	Calculate product amounts by using known reactant amounts, or to calculate reactant amounts given known product amounts, based on the proportionality of moles of reactants and products in the balanced chemical equations and ideal gas law for gaseous reactions (4.5.A.3).		4.5.A.3	Quarter 1
Chapter 5: Gas Laws	Explain the relationship between the motion of particles and the macroscopic properties of gases with: i. The kinetic molecular theory (KMT). i. A particulate model. i. A graphical representation (3.5.A).	Characterize the behavior of gases according to the kinetic molecular theory (KMT) which relates the macroscopic properties of gases to motions of the particles in the gas. Analyze the graphical representations (Maxwell-Boltzmann distribution) of the distribution of kinetic energy of gas particles at a given temperature (3.5.A.1-4).	Kinetic Molecular Theory (KMT), Maxwell-Boltzmann Distribution, Kinetic Energy, Velocity	3.5.A.1, 3.5.A.2, 3.5.A.3, 3.5.A.4	Quarter 1
Chapter 5: Gas Laws	Explain the relationship amongnon-ideal behaviors of gases, interparticle forces, and/or volumes (3.6.A).	Describe behavior of non-ideal gases and understand that deviations from the ideal gas law may result from interparticle attractions among gas molecules and particle volumes (3.6.A.1).	Non-Ideal Gas	3.6.A.1	Quarter 1
Chapter 6: Thermochemistry	Explain the relationship between experimental observations and energy changes associated with a chemical or physical transformation (6.1.A).	Characterize reactions based on the temperature changes that indicate a chemical reaction occurred. Differentiate between endothermic and exothermic reactions based on energy transfer between the system and surroundings. Predict energy changes for a process based on interactions between particles (6.1.A.1-4).	Endothermic, Exothermic, Enthalpy, System, Surroundings	6.1.A.1, 6.1.A.2, 6.1.A.3, 6.1.A.4	Quarter 2
Chapter 6: Thermochemistry	Calculate the heat q absorbed or released by a system undergoing heating/ cooling based on the amount of the substance, the heat capacity, and the change in temperature (6.4.A).	Calculate the energy of heat transfer between two systems by $q=mC\Delta T$. Apply the first law of thermodynamics to show that energy is conserved through transfer between bodies, but the temperature change between bodies do not have to be equal due to being proportional to their individual specific heat capacities. Understand that cooling decreases the energy of a system, while heating increases the energy of a system. Measure heat transfer through calorimetry (6.4.A.1-7).	Heat, Specific Heat Capacity, Molar Heat Capacity, Cooling, Heating, First Law of Thermodynamics, Calorimetry	6.4.A.1, 6.4.A.2, 6.4.A.3, 6.4.A.4, 6.4.A.5, 6.4.A.6, 6.4.A.7	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 6: Thermochemistry	Explain the relationship between the transfer of thermal energy and molecular collisions (6.3.A).	Characterize objects of different temperatures reaching thermal equilibrium based on the body of higher temperature transferring kinetic energy/heat energy to the cooler body through molecular collisions which will allowing the bodies to come to an equalized kinetic energy and temperature (6.3.A.1-3).	Thermal Equilibrium	6.3.A.1, 6.3.A.2, 6.3.A.3	Quarter 2
Chapter 6: Thermochemistry	Represent a chemical or physical transformation with an energy diagram (6.2.A).	Analyze energy diagrams of endothermic and exothermic processes (6.2.A.1).		6.2.A.1	Quarter 2
Chapter 6: Thermochemistry	Calculate the heat q absorbed or released by a system undergoing a chemical reaction in relationship to the amount of the reacting substance in moles and the molar enthalpy of reaction (6.6.A).	Calculate the enthalpy change of a reaction to give the energy released or by a chemical reaction at constant pressure. Characterize the enthalpy change of a reaction based on direction of thermal energy transfer which manifests as a temperature change of the reaction due to the difference in chemical energy between the reactants and products by bonds breaking and forming (6.6.A.1-3).	Chemical Energy, Bond Energy, Enthalpy Change	6.6.A.1, 6.6.A.2, 6.6.A.3	Quarter 2
Chapter 6: Thermochemistry	Calculate the enthalpy change for a chemical or physical process based on the standard enthalpies of formation (6.8.A).	Calculate the standard enthalpies of reactions using standard enthalpy of formation values (6.8.A.1).	Standard Enthalpy Change, Standard Enthalpy of Formation	6.8.A.1	Quarter 2
Chapter 6: Thermochemistry	Represent a chemical or physical process as a sequence of steps (6.9.A).	Understand that chemical processes can be broken down into a series of steps, each of which has its own energy change (6.9.A.1).	Overall Reaction	6.9.A.1	Quarter 2
Chapter 6: Thermochemistry	Explain the relationship between the enthalpy of a chemical or physical process and the sum of the enthalpies of the individual steps (6.9.B).	Define state function in which quantities are pathway-independent and therefore can be calculated by Hess's law. Calculate enthalpy change by using Hess's law in which overall enthalpy change for a reaction is equivalent to the summation of the enthalpy changes of its individual steps (6.9.B.1-2).	Hess's Law	6.9.B.1, 6.9.B.2	Quarter 2
Chapter 7: Atomic Structure and Periodicity	Represent the ground-state electron configuration of an atom of an element or its ions using the Aufbau principle (1.5.A).	Apply Coulomb's law to determine the magnitude of the force between two charged particles, including between subatomic particles which is dependent on their location in the atom. Relate this to periodic trends like ionization energy. Differentiate between core and valence electrons. Identify the electron configuration of atoms and ions as explained by the Aufbau principle using the periodic table (1.5.A.1-4).	Coulomb's Law, Aufbau Principle, Core Electron, Valence Electron, Force, Electron Configuration, Energy Levels, Subshell, Orbitals, Excited State, Ground State, Ionization Energy, Shielding, Effective Nuclear Charge	1.5.A.1, 1.5.A.2, 1.5.A.3, 1.5.A.4	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 7: Atomic Structure and Periodicity	Explain the relationship between the photoelectron spectrum of an atom or ion and: i. The ground-state electron configuration of the species. ii. ii. The interactions between the electrons and the nucleus. (1.6.A).	Evaluate the experimental results of photoelectron spectroscopy by relating the position of each peak in the PES spectrum to the energy required to remove an electron from the corresponding subshell and the relative height of each peak to the number of electrons in that subshell (1.6.A.1).	Photoelectron Spectroscopy, Binding Energy	1.6.A.1	Quarter 2
Chapter 7: Atomic Structure and Periodicity	Explain the relationship between trends in atomic properties of elements and electronic structure and periodicity (1.7.A).	Explain the patterns of recurring properties present in the organization of the periodic table using ground-state electron configurations and atomic structure. Determine the trends in atomic and ionic radii, ionization energy, electron affinity, and electronegativity in order to predict values for each in the absence of data (1.7.A.1-3).	Periodic Trend, Groups, Families, Periods, Atomic Radii, Ionic Radii, Electron Affinity, Electronegativity	1.7.A.1, 1.7.A.2	Quarter 2
Chapter 7: Atomic Structure and Periodicity	Explain the properties of an absorbed or emitted photon in relationship to an electronic transition in an atom or molecule (3.12.A).	Describe behavior of electrons when a photon is absorbed or emitted by an atom/molecule. Characterize and relate the wavelength, frequency, energy and speed of a wave through $c=\lambda\nu$ and $E=h\nu$ (3.12.A.1-2).	Electromagnetic Radiation, Photon, Wavelength, Frequency, Speed of Light, Radiowaves, Microwaves, Infrared, Visible Light, UV Light, X-rays, Gamma Rays	3.12.A.1, 3.12.A.2	Quarter 2
Chapter 7: Atomic Structure and Periodicity	Explain the relationship between a region of the electromagnetic spectrum and the types of molecular or electronic transitions associated with that region (3.11.A).	Differentiate between the electron transitions in an atom associated with different forms of electromagnetic radiation (3.11.A.1)	Electron Transitions, Molecular Rotational Levels, Molecular Vibrational Levels, Electronic Energy Levels	3.11.A.1	Quarter 2
Chapter 8 and 9: Molecular Structure	Explain the relationship between the type of bonding and the properties of the elements participating in the bond (2.1.A).	Characterize type of bonding (nonpolar, polar, ionic) based on electronegativity difference of the atoms making up the compound leading to differences in their characteristic properties. Understand that a difference in bond type is a continuum and examination of properties of a compound is a more accurate way to characterize its bonding (2.1.A.1-4).	Nonpolar, Polar, Electronegativity Difference, Property	2.1.A.1, 2.1.A.2, 2.1.A.3, 2.1.A.4	Quarter 2
Chapter 8 and 9: Molecular Structure	Represent the relationship between potential energy and distance between atoms, based on factors that influence the interaction strength (2.2.A).	Analyze potential energy versus internuclear distance to characterize bonding interactions between atoms. Characterize covalent bonding in terms of bond length, bond strength, bond energy, and bond order (2.2.A.1-2).	Internuclear Distance, Potential Energy, Bond Energy, Bond Length, Bond Order, Bond Strength	2.2.A.1, 2.2.A.2	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 8 and 9:	Represent a molecule with a Lewis diagram (2.5.A).	Construct Lewis structures according to the octet rule (2.5.A.1).	Lewis Structure/ Diagram, Octet Rule	2.5.A.1	Quarter 2
Chapter 8 and 9: Molecular Structure	Represent a molecule with a Lewis diagram that accounts for resonance between equivalent structures or that uses formal charge to select between nonequivalent structures (2.6.A).	Construct resonance structures for compounds where more than one Lewis structure can be constructed and understand that resonance is necessary to describe molecular structure and properties. Determine the best representation of molecular structure when resonance is present by calculating formal charge. Discuss limitations in the Lewis structure model, particularly in cases with an odd number of valence electrons (2.6.A.1-3).	Resonance, Formal Charge	2.6.A.1, 2.6.A.2, 2.6.A.3	Quarter 2
Chapter 8 and 9: Molecular Structure	Based on the relationship between Lewis diagrams, VSEPR theory, bond orders, and bond polarities: i. Explain structural properties of molecules. ii. Explain electron properties of molecules (2.7.A).	Apply VSEPR theory to predict the three-dimensional structure, electron geometry, molecular geometry, bond angles, and presence of a dipole moment of covalently bonded molecules and polyatomic ions. Use hybridization theory to describe the arrangement of electrons around a central atom in hybridized orbitals. Understand that atomic orbitals overlap during covalent bonding to form sigma and pi bonds and that the overlapping differences create bonds of different energies. Relate type of bond to bond rotation and the creation of geometric isomers (2.7.A.1-4).	VSEPR Theory, Electron Geometry, Molecular Geometry, Linear, Trigonal Planar, Tetrahedral, Octahedral, Trigonal Bipyramidal, Bond Angle, Dipole Moment, Hybridization, Hybrid Orbital, Central Atom, Sigma Bond, Pi Bond, Geometric Isomer	2.7.A.1, 2.7.A.2, 2.7.A.3, 2.7.A.4	Quarter 2
Chapter 8 and 9: Molecular Structure	Calculate the enthalpy change of a reaction based on the average bond energies of bonds broken and formed in the reaction (6.7.A).	Calculate the enthalpy change of a reaction based on the sum of energy changes when bonds are formed (releases energy) and broken (requires energy). Identify a reaction as endothermic or exothermic based on this value (6.7.A.1-2).		6.7.A.1, 6.7.A.2	Quarter 2
Chapter 10 and 11: Properties and Interactions of Molecules	Explain the relationship between the type of bonding and the properties of the elements participating in the bond (2.1.A).	Characterize type of bonding (nonpolar, polar, ionic) based on electronegativity difference of the atoms making up the compound leading to differences in their characteristic properties. Understand that a difference in bond type is a continuum and examination of properties of a compound is a more accurate way to characterize its bonding. Recall that metallic solids have delocalized electrons (2.1.A.1-5).	Metallic, Delocalized	2.1.A.1, 2.1.A.2, 2.1.A.3, 2.1.A.4, 2.1.A.5	Quarter 2
Chapter 10 and 11: Properties and Interactions of Molecules	Represent a metallic solid and/or alloy using a model to show essential characteristics of the	Characterize metallic solids forming a lattice of positive metal ions surrounded by delocalized electrons. Differentiate between interstitial and	Lattice, Alloy, Interstitial, Substitutional	2.4.A.1, 2.4.A.2, 2.4.A.3	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	structure and interactions present in the substance (2.4.A).	substitutional alloys according to their structure and properties (2.4.A.1-3)			
Chapter 10 and 11: Properties and Interactions of Molecules	Represent the relationship between potential energy and distance between atoms, based on factors that influence the interaction strength (2.2.A).	Characterize ionic bonding in terms of its lattice energy which can be determined by Coulomb's law since it is directly proportional to ion charge and inversely proportional to distance between ions (2.2.A.3).	Lattice Energy	2.2.A.3	Quarter 2
Chapter 10 and 11: Properties and Interactions of Molecules	Explain the relationship between the chemical structures of molecules and the relative strength of their intermolecular forces when: i. The molecules are of the same chemical species. ii. The molecules are of two different chemical species (3.1.A).	Identify types of intermolecular forces between molecules of the same species and between molecules of different species. Differentiate between the types of intermolecular forces based on presence of dipole and relative strength. Identify how intermolecular forces are directional in charged molecules and how this orients molecules in arrangements. Recall that different intermolecular forces can occur between different regions of molecules if they are of large size (3.1.A.1-5).	Intermolecular Forces (IMF), Intramolecular Forces, London Dispersion Forces, Dipole-Dipole Forces, Dipole-Induced Dipole Forces, Hydrogen Bonding, Ion-Dipole Forces	3.1.A.1, 3.1.A.2, 3.1.A.3, 3.1.A.4, 3.1.A.5	Quarter 2
Chapter 10 and 11: Properties and Interactions of Molecules	Explain the relationship among the macroscopic properties of a substance, the particulate-levelstructureof the substance, and the interactions between these particles (3.2.A).	Identify and predict properties of liquids and solids based on the strengths and types of intermolecular forces present. Understand that vapor pressure, boiling point, and melting point are correlated to strength of intermolecular interactions. Represent interactions at the particulate level to communicate or understand how intermolecular interactions establish macroscopic properties. Recall that properties of ionic solids like low vapor pressure, high melting point, high boiling point, brittleness, and conduction of electricity in various states of matter are determined by their structure and interactions between ions (3.2.A.1-4).	Vapor Pressure, Melting Point, Boiling Point, Macroscopic, Conductor	3.2.A.1, 3.2.A.2, 3.2.A.3, 3.2.A.4	Quarter 2
Chapter 10 and 11: Properties and Interactions of Molecules	Explain changes in the heat q absorbed or released by a system undergoing a phase transition based on the amount of the substance in moles and the molar enthalpy of the phase transition (6.5.A).	Characterize heating, cooling and phase changes based on energy transfer. Calculate heat transferred by each of these processes (6.5.A.1-2).	Enthalpy of Fusion, Enthalpy of Vaporization	6.5.A.1, 6.5.A.2	Quarter 2
Chapter 10 and 11: Properties and Interactions of Molecules	Explain the relationship between the solubility of ionic and molecular compounds in aqueous and nonaqueous solvents, and the	Identify that substances with similar intermolecular interactions tend to be miscible or soluble in one another (3.10.A.1).	Miscibility, Solubility	3.10.A.1	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	intermolecular interactions between particles (3.10.A).				
Chapter 10 and 11: Properties and Interactions of Molecules	Explain the amount of light absorbed by a solution of molecules or ions in relationship to the concentration, path length, and molar absorptivity (3.13.A).	Apply the Beer-Lambert law that relates absorption of light to concentration. Determine unknown molarity of a solution based on absorption (3.13.A.1-2).	Beer-Lambert Law, Absorption, Transmittance, Molar Absorptivity, Pathlength	3.13.A.1, 3.13.A.2	Quarter 2
Chapter 10 and 11: Properties and Interactions of Molecules	Explain the results of a separation experiment based on intermolecular interactions (3.9.A).	Explain how separation of mixture techniques (filtration, chromatography, distillation) separate various types of mixtures based on interactions of the components (3.9.A.1).		3.9.A.1	Quarter 2
Chapter 12: Kinetics	Explain the relationship between the rate of a chemical reaction and experimental parameters (5.1.A).	Define kinetics of a chemical reaction as the rate at which an amount of reactants is converted to products per unit of time. Understand that the rates of change of reactant and product concentrations are determined bythe stoichiometry in the balanced chemical equation. Identify how rate of a reaction is influenced by reactant concentrations, temperature, surface area, catalysts, and other environmental factors (5.1.A.1-3).	Kinetics, Rate of Change, Catalysts	5.1.A.1, 5.1.A.2, 5.1.A.3	Quarter 3
Chapter 12: Kinetics	Represent experimental data with a consistent rate law expression (5.2.A).	Express the rate of a reaction with a rate law, which is proportional to the concentration of each reactant raised to a power which can only de determined experimentally. Use the method of initial rates to identify a rate law, reaction order with respect to each reactant, and overall reaction order (5.2.A.1-5).	Rate Law, Rate Order, Method of Initial Rates, Rate Constant	5.2.A.1, 5.2.A.2, 5.2.A.3, 5.2.A.4, 5.2.A.5	Quarter 3
Chapter 12: Kinetics	Identify the rate law expression of a chemical reaction using data that show how the concentrations of reaction species change over time (5.3.A).	Identify the rate law of a reaction by the slopes of concentration of a reactant versus time based on order with respect to a reactant. Classify the rate of decay and half-lives of first-order radioactive materials (5.3.A.1-5).	Integrated Rate Law, Half-Life, Radioactive Decay	5.3.A.1, 5.3.A.2, 5.3.A.3, 5.3.A.4, 5.3.A.5, 5.3.A.6	Quarter 3
Chapter 12: Kinetics	Identify the components of a reaction mechanism (5.7.A).	Recognize reaction mechanisms consisting of a series of elementary reactions, or steps, which occur in sequence that add up to an overall reaction. Identify reactants, products, intermediates, and catalysts based on the reaction mechanism. The components may include reactants, intermediates, products, and catalysts and how their amounts vary throughout a	Elementary Reaction, Mechanism, Intermediate	5.7.A.1, 5.7.A.2, 5.7.A.3, 5.7.A.4	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		mechanism. Discuss how evidence can be gathered in an experiment to support a theoretical mechanism (5.7.A.1-4).			
Chapter 12: Kinetics	Represent an elementary reaction as a rate law expression using stoichiometry (5.4.A).	Determine the rate law of an elementary reaction based on the molecularity/stoichiometry of the particles participating in a collision (5.4.A.1-2).	Molecularity, Unimolecular, Bimolecular, Termolecular	5.4.A.1, 5.4.A.2	Quarter 3
Chapter 12: Kinetics	Identify the rate law for a reaction from a mechanism in which the first step is rate limiting (5.8.A).	Determine the rate of a reaction mechanism based on the slowest or rate-determining step (5.8.A.1).	Rate-Determining Step	5.8.A.1	Quarter 3
Chapter 12: Kinetics	Identify the rate law for a reaction from a mechanism in which thefirst step is not rate limiting (5.9.A).	Use the steady state/pre-equilibrium approximation to determine the rate of a reaction mechanism including a reaction intermediate (5.9.A.1).	Steady State Approximation, Pre-Equilibrium Approximation	5.9.A.1	Quarter 3
Chapter 12: Kinetics	Explain the relationship between the rate of an elementary reaction and the frequency, energy, and orientation of particle collisions (5.5.A).	Discuss collision theory as it relates to elementary reactions to successfully produce products. Understand that not all collisions between reactants produce produces based on activation energy and orientation requirements. Relate this to Maxwell-Boltzmanndistribution curves and temperature (5.5.A.1-3).	Collision Theory, Activation Energy	5.5.A.1, 5.5.A.2. 5.5.A.4	Quarter 3
Chapter 12: Kinetics	Represent the activation energy and overall energy change in an elementary reaction using a reaction energyprofile (5.6.A).	Characterize elementary reactions using reaction energy profiles that show reaction progress (reactants forming products), relative energies of molecular structures in the reaction as the reaction progresses, the reaction's activation energy, and the reaction's overall energy/enthalpy change (5.6.A.1-4).	Reaction Energy Profile, Reaction Coordinate, Transition State	5.6.A.1, 5.6.A.2, 5.6.A.3, 5.6.A.4	Quarter 3
Chapter 12: Kinetics	Represent the activation energy and overall energy change in a multistep reaction with a reaction energy profile (5.10.A).	Construct a reaction energy profile for a reaction mechanism (5.10.A.1).		5.10.A.1	Quarter 3
Chapter 12: Kinetics	Explain the relationship betweenthe effect of a catalyst on a reaction and changes in the reaction mechanism (5.11.A).	Discuss how catalysts increase the rate of a reaction by increasing the number of effective collisions or by providing an alternate reaction pathway with a lower activation energy. Recall that some catalysts bind to the reactants to create a new intermediate and reaction mechanism (5.11.A.1-5).		5.11.A.1, 5.11.A.2, 5.11.A.3, 5.11.A.4, 5.11.A.5	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 13: Equilibrium	Explain the relationship between the occurrence of a reversible chemical or physical process, and the establishment of equilibrium, to experimental observations (7.1.A).	Identify processes that are reversible are characterized by a dynamic equilibrium in which the forward and reverse process occurs at equal rates causing no net change to be observable despite changes occurring at the particulate level. Analyze graphical representation of equilibrium (7.1.A.1-4).	Equilibrium	7.1.A.1, 7.1.A.2, 7.1.A.3, 7.1.A.4	Quarter 3
Chapter 13: Equilibrium	Explain the relationship between the direction in which a reversible reaction proceeds and the relative rates of the forward and reverse reactions (7.2.A).	Predict the direction a reaction proceeds to reach equilibrium based on the ratio of forward and reverse rates due to the fact that if the rates are not equal, there will be a net conversion between reactants and products in order to establish equilibrium (7.2.A.1).	Forward Reaction, Reverse Reaction	7.2.A.1	Quarter 3
Chapter 13: Equilibrium	Represent the reaction quotient Qc or Qp , for a reversible reaction, and the corresponding equilibrium expressions Kc = Qc or Kp = Qp (7.3.A).	Express equilibrium in terms of the equilibrium constant (K and Kp), which shows the ratio of products to reactants at equilibrium. Express this ratio at any time using the reaction quotient (Q and Qp). Understand that substances whose concentration/pressure are constant are not present in the equilibrium expression (7.3.A.1-2).	Equilibrium Constant, Reaction Quotient	7.3.A.1, 7.3.A.2	Quarter 3
Chapter 13: Equilibrium	Calculate Kc or Kp based on experimental observations of concentrations or pressures at equilibrium (7.4.A).	Calculate Kc or Kp based on experimental observations of concentrations or pressures at equilibrium (7.4.A.1).		7.4.A.1	Quarter 3
Chapter 13: Equilibrium	Explain the relationship between very large or very small values of K and the relative concentrations of chemical species at equilibrium (7.5.A).	Relate the magnitude of the equilibrium constants to the relative concentrations of chemical species at equilibrium (7.5.A.1).		7.5.A.1	Quarter 3
Chapter 13: Equilibrium	Represent a multistep process with an overall equilibrium expression, using the constituent K expressions for each individual reaction (7.6.A).	Represent a multistep process with an overall equilibrium expression, using the constituent K expressions for each individual reaction. Understand how constituent K expressions are determined based on how the original reaction is modified to add to the overall reaction (7.6.A.1-4).		7.6.A.1, 7.6.A.2, 7.6.A.3, 7.6.A.4	Quarter 3
Chapter 13: Equilibrium	Identify the concentrations or partial pressures of chemical species at equilibrium based on the initial conditions and the equilibrium constant (7.7.A).	Calculate the concentration or partial pressures of species at equilibrium based on the balanced reaction, initial concentrations, and the appropriate K. Determine which direction a reaction will shift to establish equilibrium by comparing Q to K (7.7.A.1-2).		7.7.A.1, 7.7.A.2	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 13: Equilibrium	Represent a system undergoing a reversible reaction with a particulate model (7.8.A).	Represent a system undergoing a reversible reaction with a particulate model based on the ratio of product to reactant particles present to and at equilibrium (7.8.A.1).		7.8.A.1	Quarter 3
Chapter 13: Equilibrium	Identify the response of a system at equilibrium to an external stress, using Le Châtelier's principle (7.9.A).	Use Le Chatlier's principle to predict how a system will shift in order to reestablish equilibrium in response to a stress. Predict how species concentration, pH, temperature, and color of a solution changes as a response (7.9.A.1-2).	Le Chatlier's Principle, Stressor	7.9.A.1, 7.9.A.2	Quarter 3
Chapter 13: Equilibrium	Explain the relationships between Q, K, and the direction in which a reversible reaction will proceed to reach equilibrium (7.10.A).	Understand that a stressor disrupts a reaction at equilibrium which causes Q to differ from K, and the reaction will change until equilibrium is reestablished. Understand that some stressors change concentrations until Q=K while others change the value of K, both establishing a new equilibrium state (7.10.A.1-2).		7.10.A.1, 7.10.A.2	Quarter 3
Chapter 14: Acid-Base Reactions	Identify species as Brønsted-Lowry acids, bases, and/or conjugate acid-base pairs, basedon proton-transfer involving those species (4.8.A).	Define acids and bases using the Bronsted-Lowry definition where acids are a proton donor, and bases are a proton acceptor. Understand that water plays an important role in aqueous acid-base reactions by acting as either an acid or base due to its molecular structure allowing both. Identify conjugate acid-base pairs and compare their strength as acids or bases (4.8.A.1-3).	Bronsted-Lowry Acid, Bronsted-Lowry Base, Proton, Hydronium Ion, Amphoteric, Conjugate Acid-Base Pair, Conjugate Acid, Conjugate Base	4.8.A.1, 4.8.A.2, 4.8.A.3	Quarter 3
Chapter 14: Acid-Base Reactions	Explain the relationship between the strength of an acid or base and the structure of the molecule or ion (8.6.A).	Relate structure of an acid or base to its strength (8.6.A.1).		8.6.A.1	Quarter 3
Chapter 14: Acid-Base Reactions	Calculate the values of pH and pOH, based on Kw and the concentration of all species present in a neutral solution of water (8.1.A).	Express concentrations of the hydronium and hydroxide ion as pH and pOH. Understand that water autoionizes with an equilibrium constant Kw, which causes the hydronium and hydroxide concentration to be equal, pH=pOH, and pKw = pH + pOH to be true in pure, neutral water. Understand that equilibrium is temperature dependent and neutral water only has a pH=7.0 at 25°C (8.1.A.1-4).	pH, pOH, Kw, Hydronium Ion, Neutral	8.1.A.1, 8.1.A.2, 8.1.A.3, 8.1.A.4	Quarter 3
Chapter 14: Acid-Base Reactions	Calculate pH and pOH based on concentrations of all species in a solution of a strong acid or a strong base (8.2.A).	Calculate pH and pOH based on concentrations of all species in a solution of a strong acid or a strong base. Identify common strong acids and bases and how they completely dissociate into their ions in	Strong Acid, Strong Base, Dissociation	8.2.A.1, 8.2.A.2	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		water (8.2.A.1-2).			
Chapter 14: Acid-Base Reactions	Explain the relationship among pH, pOH, and concentrations of all species in a solution of a monoprotic weak acid or weak base (8.3.A).	Calculate pH and pOH based on concentrations of all species in a solution of a weak acid or a weak base. Identify common weak acids and bases and how they do not completely dissociate into their ions in water. Understand the extent of weak acid and weak base dissociation is determined by the magnitude of their Ka or Kb and is commonly expressed as percent dissociation. Write dissociation equations for weak acid and base solutions in which their conjugate pairs are produced. Understand that KaKb=Kw for a conjugate acid base pair (8.3.A.1-6).	Weak Acid, Weak Base, Percent Dissociation, Ka, Kb, pKa	8.3.A.1, 8.3.A.2, 8.3.A.3, 8.3.A.4, 8.3.A.5, 8.3.A.6	Quarter 3
Chapter 14: Acid-Base Reactions	Explain the relationship among the concentrations of major species in a mixture of weak and strong acids and bases (8.4.A).	Calculate pH of a solution after an acid-base reaction takes place depending on the excess reactant. Understand the differences between reactions with strong acids and bases and weak acids and bases. Predict products of acid base reactions (8.4.A.1-4).		8.4.A.1, 8.4.A.2. 8.4.A.3, 8.4.A.4	Quarter 3
Chapter 15: Applications of Aqueous Equilibrium	Explain the relationship between the ability of a bufferto stabilize pH and the reactions that occur when an acid or a base is added to a bufferedsolution (8.8.A).	Understand that a buffer solution containsa large concentration of both members in a conjugate acid-base pair which protects the solution against changes in pH when an acid or base is added (8.8.A.1).	Buffer	8.8.A.1	Quarter 3
Chapter 15: Applications of Aqueous Equilibrium	Identify the pH of a buffer solution based on the identity and concentrations of the conjugateacid-base pair used to create thebuffer (8.9.A).	Calculate the pH of a buffer solution using the Henderson-Hasselbalch equation. Understand that this shows how buffers resist changes in pH since the pH depends on the ratio of the conjugate pair which does not change significantly with the addition of an acid or base (8.9.A.1).	Henderson-Hasselbalch Equation	8.9.A.1	Quarter 3
Chapter 15: Applications of Aqueous Equilibrium	Explain the relationship betweenthe buffer capacity of a solution and the relative concentrations of the conjugate acid and conjugate base components of the solution (8.10.A).	Define buffer capacity and determine the capacity of a buffer based off of its composition when an acid or base is added (8.10.A.1-2).	Buffer Capacity	8.10.A.1, 8.10.A.2	Quarter 3
Chapter 15: Applications of Aqueous Equilibrium	Explain results from the titrationof a mono- or polyprotic acid or base solution, in relation to the properties of the solution and its components (8.5.A).	Analyze titration curves, a graphical representation of pH against volume of the titrant. Identify the use of the equivalence point where moles of analyte and moles of titrant are equal for monoprotic acids. Identify the use of the half-equivalence point in	Monoprotic, Polyprotic, Titration Curve, Half-Equivalence Point	8.5.A.1, 8.5.A.2, 8.5.A.3, 8.5.A.4, 8.5.A.5	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		titrations of weak acids and bases where pH=pKa. Explain that pH=pKa at the half-equivalence point due to equal concentrations of each species in theconjugate acid-base pair. Determine the major species in solution at any point in a titration. Understand that titrations of polyprotic acids can be used to determine the number of acidic protons in an acid (8.5.A.1-5).			
Chapter 15: Applications of Aqueous Equilibrium	Explain the relationship between the predominant form of a weak acid or base in solution at a given pH and the pKa of the conjugate acid or the pKb of the conjugate base (8.7.A).	Predict the protonation state of an acid or base (i.e., the relative concentrations of HA and A^-) by comparing the pH of a solution to the pKa of the acid in that solution. Understand that pH indicators can be used to identify the protonation state and that they are chosen for color changes to occur near the pH of the equivalence point, which is around the pKa of the acid (8.7.A.1-3).	Protonation State	8.7.A.1, 8.7.A.2, 8.7.A.3	Quarter 3
Chapter 15: Applications of Aqueous Equilibrium	Calculate the solubility of a salt based on the value of Ksp for the salt (7.11.A).	Understand that he dissolution of a salt is a reversible process whose extent can be described by Ksp, the solubility-productconstant. Calculate the solubility of a substance from the Ksp for the dissolution process. Relate and predict the extent a salt can dissolve to solubility rules and magnitude of K. Calculate the solubility product constant from molar solubility (7.11.A.1-4).	Solubility Product Constant	7.11.A.1, 7.11.A.2, 7.11.A.3, 7.11.A.4	Quarter 3
Chapter 15: Applications of Aqueous Equilibrium	Identify the solubility of a salt, and/or the value of Ksp for the salt, based on the concentration of a common ion already present in solution (7.12.A).	Identify the solubility of a salt, and/or the value of Ksp for the salt, based on the concentration of a common ion already present in solution. Explain qualitatively using Le Chatlier's Principle (7.12.A.1).	Common Ion Effect	7.12.A.1	Quarter 3
Chapter 15: Applications of Aqueous Equilibrium	Identify the qualitative effect of changes in pH on the solubility of a salt (8.11.A).	Explain that solubility of a salt is pH dependent when ions in the salt are conjugates of weak acids or bases or the hydroxide ion using Le Chatlier's principle (8.11.A.1).		8.11.A.1	Quarter 3
Chapter 16 and 17: Thermodynamics and Electrochemistry	Identify the sign and relative magnitude of the entropychange associated with chemical or physical processes (9.1.A).	Define entropy and relate it to dispersal of matter and temperature. Predict whether a system increases or decreases entropy reactants (9.1.A.1-2).	Entropy	9.1.A.1, 9.1.A.2	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Calculate the standard entropy change for a chemical or physical process based on the absolute	Calculate the standard entropy change for a chemical or physical process based on the absolute entropies (standard molar entropies) of the species	Absolute Entropy, Standard Entropy Change	9.2.A.1	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
	entropies (standard molar entropies) of the species involvedin the process (9.2.A).	involved in the process (9.2.A.1).			
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain whether a physical or chemical process is thermodynamically favored based on an evaluation of ΔG^o (9.3.A). .	Explain whether a physical or chemical process is thermodynamically favored based on an evaluation of ΔG^o . Define thermodynamically favored. Calculate standard Gibbs free energy change. Explain that the thermodynamic favorability of some processes depend on enthalpy change, entropy change, and Gibbs free energy change. Explain how thermodynamic favorability can change depending on temperature (9.3.A.1-6).	Gibbs Free Energy, Standard Gibbs Free Energy Change, Thermodynamically Favored, Spontaneous	9.3.A.1, 9.3.A.2, 9.3.A.3, 9.3.A.4, 9.3.A.5, 9.3.A.6	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain, in terms of kinetics, why a thermodynamically favored reaction might not occur at a measurable rate (9.4.A).	Explain, in terms of kinetics, why a thermodynamically favored reaction might not occur at a measurable rate due to kinetics reasons. Define reactions like these as under kinetic control, often due to high activation energies (9.4.A.1-2).	Kinetic Control	9.4.A.1, 9.4.A.2	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain whether a process is thermodynamically favored using the relationships between K, ΔG^o, and T (9.5.A).	Use the relationship to calculate the value of the equilibrium constant and ΔG^o. Use the relationship between the variables to predict values of each (9.5.A.1-4).		9.5.A.1, 9.5.A.2, 9.5.A.3, 9.5.A.4	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain the relationship between the solubility of a salt and changes in the enthalpy and entropy that occur in the dissolution process (9.6.A).	Relate free energy change ($\Delta G°$) fordissolution of a substance with a number offactors, such as the breaking of the intermolecular interactions that hold the solid together, the reorganization of the solvent around the dissolved species, and the interaction of the dissolved species with the solvent. Estimate the sign and relative magnitude of the enthalpic and entropic contributions to each of these factors (9.6.A.1).		9.6.A.1	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain the relationship between external sources of energy or coupled reactions and their ability to drive thermodynamically unfavorable processes (9.7.A).	Understand how an external source of energy or coupling an unfavorable reaction to a favorable one can be used to make a thermodynamically unfavorable process occur. Identify a coupled system based on the individual reactions share one or more common intermediates. Apply the sum of the individual reactions produces an overall reaction that achieves the desired Gibbs free energy change to ensure favorability (9.7.A.1-2).	Coupled Reaction	9.7.A.1, 9.7.A.2	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Chapter 16 and 17: Thermodynamics and Electrochemistry	Represent a balanced redox reaction equation using half-reactions (4.9.A).	Balance chemical equations for redox reactions from half-reactions (4.9.A.1).	Half-Reactions	4.9.A.1	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain the relationship between the physical components of an electrochemical cell and the overall operational principles of the cell (9.8.A).	Identify the parts of an electrochemical cell and their functions. Understand the operational characteristics of an electrochemical cell such as composition and changes in each half-cell, transfer of electrons, and transfer of energy between cells (9.8.A.1-3).	Anode, Cathode, Electrode, Salt Bridge, Half-Cell, Galvanic Cell, Voltaic Cell, Electrolytic Cell, Electrochemical Cell	9.8.A.1, 9.8.A.2, 9.8.A.3	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain whether an electrochemical cell is thermodynamically favored, based on its standard cell potential and the constituent half reactions in a cell (9.9.A).	Identify a redox reaction occurring in an electrochemical cell as thermodynamically favored or unfavored based on the voltage produced. Calculate the standard cell potential using standard reduction potentials of its half reactions or its relation to Gibbs free energy (9.9.A.1-3).	Standard Reduction Potential, Standard Cell Potential	9.9.A.1, 9.9.A.2, 9.9.A.3	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Explain the relationship between deviations from standard cell conditions and changes in the cell potential (9.10.A).	Understand that cell potential varies based on concentrations of active species and is the driving force towards equilibrium. Identify how close a cell is to equilibrium based on its cell potential. Relate standard cell potential to the reaction quotient and reaction constant. Explain qualitative effects of concentration on cell potential using the Nernst equation (9.10.A.1-4).	Nernst Equation	9.10.A.1, 9.10.A.2, 9.10.A.3, 9.10.A.4	Quarter 4
Chapter 16 and 17: Thermodynamics and Electrochemistry	Calculate the amount of charge flow based on changes in the amounts of reactants and products in an electrochemical cell (9.11.A).	Use Faraday's law to determine the stoichiometry of the redox reaction occurring in an electrochemical cell with respect to the following: i. Number of electrons transferred ii. Mass of material deposited on or removed from an electrode (as in electroplating) iii. Current iv. Time elapsed v. Charge of ionic species (9.11.A.1).	Faraday's Law	9.11.A.1	Quarter 4

College in High School
Concepts of Chemistry CHEM 0089

Course Description

This course is designed for non-majors or students intending to take CHEM 0101 and CHEM 0102 who require additional preparation. The course emphasizes stoichiometry (chemical calculations), chemical equations, gas laws, elementary atomic structure and periodic properties of elements.

Course Objectives

To acquaint students with computational methods and concepts that are commonly used in General Chemistry I and II.

Textbook

The recommended text for the course is *Basic Chemistry, 5th Edition*, Timberlake and Timberlake, Pearson, 2017. Other textbooks will be considered by the faculty liaison on a case-by-case basis.

Course Topics

1. Scientific method, measurements, significant figures
2. Conversions
3. Matter, elements and compounds, atomic structure & weight, energy
4. Light, electron configs., periodic trends (TEST)
5. Naming and formulae, ionic and covalent bonding
6. Formulae, moles, % composition
7. Reactions, balancing, organic groups (TEST)
8. Stoichiometry
9. Limiting reagents and yields

10. Lewis structures, shapes, intermolecular forces (TEST)
11. Gas laws
12. Solutions, molarity, dilution
13. Solutions stoichiometry, colligative properties
14. Rates, equilibrium, Le Chatelier’s principle, Acids/bases

Organic Biochemistry

Statement of Organization:
This course is designed to introduce students to the principles of organic and biochemistry after successful completion of a general inorganic chemistry course. This course is structured in alignment with the curriculum and learning objectives commonly found in college-level courses in this subject area.

Expected Levels of Achievement:
Students are expected to master the objectives taught by achieving at least eighty percent (80%) on all graded forms of assessment.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Exams
- Quizzes
- Projects
- Lab Reports
- Research Assignments
- Homework

Estimated Instructional Time:
120 clock hours (1 school year)

Sequence
The Big Ideas/Reporting Categories are listed in order of delivery.

Technology Integration:
In addition to print resources, students will use technology when available and applicable to achieve learning goals and generate products in conjunction with the standards, such as use of approved websites for research projects, online chemical modelling tools, and online molecular simulations.

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Pacing
Introduction to Organic Chemistry	Distinguish between inorganic and organic compounds.	Students should be able to differentiate between inorganic and organic compounds based on structure and identify organic functional groups.	Inorganic Organic Hydrocarbon Functional Groups	Quarter 1
Introduction to Organic Chemistry	Model organic compounds using molecular, structural, condensed, and line formulas.	Students should be able to identify, draw, and represent organic compounds using molecular, structural, condensed, and line formulas.	Molecular Formula Structural Formula Condensed (Structural) Formula Line (Skeletal) Formulas	Quarter 1
Introduction to Organic Chemistry	Predict properties of organic compounds based on structural characteristics and interactions between compounds.	Students should be able to identify properties of a molecule based on polarity and intermolecular forces.	Polarity/Polar/Nonpolar Intermolecular Forces Dipole-Dipole Forces Hydrogen Bonding London Dispersion Forces Saturated/Unsaturated Aliphatic/Aromatic Hydrophobic/Hydrophilic	Quarter 1
Alkanes (Functional Group)	Identify and model alkanes using the systematic/IUPAC naming system.	Students should be able to name, draw, and model alkanes using the systematic/IUPAC naming system.	Alkanes Systematic	Quarter 1
Alkanes (Functional Group)	Identify and model alkanes using the trivial naming system.	Students should be able to name, draw, and model alkanes using common names/the trivial naming system.	Trivial	Quarter 1
Alkanes (Functional Group)	Predict properties of alkanes based on structural characteristics and interactions between compounds.	Students should be able to identify properties of alkanes based on polarity and intermolecular forces.	Paraffins	Quarter 1
Alkanes (Functional Group)	Identify and model isomers of alkanes.	Students should be able to define, identify properties of, and draw structural and conformational isomers of alkanes.	Isomers Structural (Constitutional) Isomers Conformational Isomers (Conformers) Newman Projection	Quarter 1
Alkanes (Functional Group)	Recognize the patterns of common organic reactions involving alkanes in order to predict products.	Students should be able to identify, discuss characteristics of, and predict the products of common organic reactions involving alkanes.	Combustion Substitution Elimination Addition Isomerization Cracking Halogenation Dehydrogenation	Quarter 1

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Pacing
Alkenes and Alkynes (Functional Groups)	Identify and model alkenes and alkynes using the systematic/IUPAC naming system.	Students should be able to name, draw, and model alkenes and alkynes using the systematic/IUPAC naming system.	Alkenes Alkynes	Quarter 1
Alkenes and Alkynes (Functional Groups)	Identify and model geometric isomers of alkenes using the systematic/IUPAC naming system.	Students should be able to name, draw, and model alkenes using the systematic/IUPAC naming system.	Stereoisomers Geometric Isomers Cis/Trans Isomers E/Z Isomers Cahn-Ingold Prelog Rules	Quarter 1
Alkenes and Alkynes (Functional Groups)	Identify and model alkenes using the trivial naming system.	Students should be able to name, draw, and model alkenes using common names/the trivial naming system.		Quarter 1
Alkenes and Alkynes (Functional Groups)	Predict properties of alkenes and alkynes based on structural characteristics and interactions between compounds.	Students should be able to identify properties of alkenes and alkynes based on polarity and intermolecular forces.	Paraffins	Quarter 1
Alkenes and Alkynes (Functional Groups)	Identify and model isomers of alkenes.	Students should be able to define, identify properties of, and draw structural and geometric isomers of alkenes.	Positional Isomers Functional Group Isomers Skeletal Isomers Geometric Isomers	Quarter 1
Alkenes and Alkynes (Functional Groups)	Recognize the patterns of common organic reactions involving alkenes and alkynes in order to predict products.	Students should be able to identify, discuss characteristics of, and predict the products of common organic reactions involving alkenes and alkynes.	Markovnikov's Rule Primary Secondary Tertiary	Quarter 1
Alcohols and Alkyl Halides (Functional Groups)	Identify and model alcohols and alkyl halides using the systematic/IUPAC naming system.	Students should be able to name, draw, and model alcohols and alkyl halides using the systematic/IUPAC naming system.	Alcohols Alkyl Halides	Quarter 2
Alcohols and Alkyl Halides (Functional Groups)	Identify and model alcohols and alkyl halides using the trivial naming system.	Students should be able to name, draw, and model alcohols and alkyl halides using common names/the trivial naming system.		Quarter 2
Alcohols and Alkyl Halides (Functional Groups)	Predict properties of alcohols and alkyl halides based on structural characteristics and interactions between compounds.	Students should be able to identify properties of alcohols and alkyl halides based on polarity and intermolecular forces.	Polar	Quarter 2
Alcohols and Alkyl Halides (Functional Groups)	Identify and model isomers of alcohols and alkyl halides	Students should be able to define, identify properties of, name and draw structural isomers of alcohols and alkyl halides.	Ether	Quarter 2
Alcohols and Alkyl Halides (Functional Groups)	Recognize the patterns of common organic reactions involving alcohols and alkyl halides in order to predict products.	Students should be able to identify, discuss characteristics of, and predict the products of common organic reactions involving alcohols and alkyl halides.	Hydration Oxidation Esterification	Quarter 2

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Pacing
Aromatic Compounds	Identify and model aromatic compounds using the systematic/IUPAC naming system.	Students should be able to name, draw, and model aromatic compounds using the systematic/IUPAC naming system.	Benzene	Quarter 3
Aromatic Compounds	Identify and model aromatic compounds using the trivial naming system.	Students should be able to name, draw, and model aromatic compounds using common names/the trivial naming system.	Ortho Meta Para	Quarter 3
Aromatic Compounds	Predict properties of aromatic compounds based on structural characteristics and interactions between compounds.	Students should be able to identify properties of aromatic compounds based on polarity and intermolecular forces.		Quarter 3
Aromatic Compounds	Identify and model isomers of aromatic compounds.	Students should be able to define, identify properties of, name and draw structural isomers of aromatic compounds.		Quarter 3
Aromatic Compounds	Recognize the patterns of common organic reactions involving aromatic compounds in order to predict products.	Students should be able to identify, discuss characteristics of, and predict the products of common organic reactions involving aromatic compounds.	Electrophilic Aromatic Substitution Nucleophile Electrophile Orto-/Meta-/Para- Directors Steric Hindrance Nitration Freidel-Crafts Alkylation	Quarter 3
Introduction to Biochemistry	Describe structure of the main biomacromolecules.	Students should be able to define and identify carbohydrates, lipids, and proteins.	Biomacromolecules Polymer Monomer Carbohydrates Lipids Proteins	Quarter 3
Stereochemistry	Identify and model stereoisomers.	Students should be able to define, identify, name and model types of stereoisomers.	Optical Isomers Chirality Enantiomers Diastereomers Epimers R-/S- Isomers Racemic Mixture Meso Compound	Quarter 3
Stereochemistry	Predict properties of compounds based on structural characteristics.	Students should be able to identify and discuss properties of compounds based on structural characteristics.	Optical Activity Specific Rotation Plane-Polarized Light Dextrorotatory Levorotatory	Quarter 3

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Pacing
Carbohydrates	Classify and model carbohydrates based on structural properties.	Students should be able to recognize and characterize structures of carbohydrates.	Aldehyde Ketone Monosaccharide Disaccharide Oligosaccharide Polysaccharide Pyranose/Furanose Glycosidic Linkage	Quarter 3
Carbohydrates	Identify and model isomers of carbohydrates.	Students should be able to define, identify properties of, name and draw structural isomers of carbohydrates.	D-/L- Isomers Fischer Projection Haworth Projection (Alpha/Beta) Anomers Penultimate	Quarter 3
Carbohydrates	Recognize the patterns of important reactions involving carbohydrates in order to predict products.	Students should be able to identify, discuss characteristics of, and predict the products of important reactions involving carbohydrates.	Kiliani-Fischer Synthesis Mutarotation Hemiacetal/Acetal Hemiketal/Ketal Hydrolysis Dehydration Synthesis	Quarter 3
Carbohydrates	Identify properties of carbohydrates.	Students should be able to discuss the properties of carbohydrates.		Quarter 3
Carbohydrates	Identify biological use of carbohydrates in the human body.	Students should be able to recognize the use of carbohydrates in the human body.		Quarter 3
Carbohydrates	Identify common foods containing carbohydrates and research the human-carb digestion pathway.	Students should be able to recognize and discuss foods and digestion as it relates to carbohydrates.	Diabetes	Quarter 3
Carbohydrates	Identify and describe laboratory tests for carbohydrates.	Students should be able to recognize and discuss chemistry of laboratory tests for carbohydrates.	Molisch's Test Tollen's Test Bial's Test Seliwanoff's Test Iodine Test Benedict's Test Barfoed's Test	Quarter 3
Lipids	Classify and model lipids based on structural properties.	Students should be able to recognize and characterize structures of fatty acids, simple lipids, compound lipids, and steroids.	Fatty Acid Simple Lipids Compound Lipids Phospholipid Sphingolipid Glycolipid Steroid	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Pacing
Lipids	Identify and model lipids.	Students should be able to define, identify properties of, name and draw lipids.	Cis-/Trans- Fats Omega Carbon Acylglycerol/Glyceride	Quarter 4
Lipids	Recognize the patterns of important reactions involving lipids in order to predict products.	Students should be able to identify, discuss characteristics of, and predict the products of important reactions involving lipids.		Quarter 4
Lipids	Identify properties of lipids.	Students should be able to discuss the properties of lipids.		Quarter 4
Lipids	Identify biological use of lipids in the human body and research steroid-abuse.	Students should be able to recognize the use of lipids in the human body.	Cell membrane Micelle Phospholipid Bilayer Liposomes Adrenocortical Hormones Bile Acids Cholesterol Sex Hormones Fat-Soluble Vitamins	Quarter 4
Lipids	Identify common foods containing lipids and research the human-lipid digestion pathway.	Students should be able to recognize and discuss foods and digestion as it relates to lipids.	Emulsification	Quarter 4
Proteins	Classify and model amino acids based on structural properties.	Students should be able to recognize and characterize structures of amino acids.	Amino Acids Side Chain Acid/Base Amphoteric	Quarter 4
Proteins	Identify and model proteins.	Students should be able to define, identify properties of, name and draw proteins.	Protein Backbone Residue Peptide Peptide Bond N-terminus C-terminus	Quarter 4
Proteins	Recognize the importance of structure in protein function.	Students should be able to identify and discuss characteristics and importance of protein structures.	Denaturation Primary Structure Secondary Structure Tertiary Structure Quaternary Structure Alpha Helix Beta Pleated Sheet Globular Protein Fibrous Protein	Quarter 4

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Pacing
Proteins	Determine laboratory processes for protein sequencing.	Students should be able to identify and discuss characteristics of protein sequencing processes.	Hydrazine Carboxypeptidase Aminopeptidase Edman's Reagent Sanger Reagent Trypsin Chymotrypsin Cyanogen Bromide	Quarter 4
Proteins	Identify biological use of proteins in the human body.	Students should be able to recognize the use of proteins in the human body.	Essential Amino Acids Complete Proteins Enzyme Blood Type Antigen Sickle Cell Anemia	Quarter 4
Proteins	Identify common foods containing proteins and research the human-protein digestion pathway.	Students should be able to recognize and discuss foods and digestion as it relates to proteins.		Quarter 4

Physics

Statement of Organization:
Physics is the study of matter and energy and the relationships between the two. The course covers force, motion, work, power, heat, light, sound and electricity.

Expected Levels of Achievement:
Students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Experiments
- Lab reports
- Observation
- Presentations
- Projects
- Teacher-made tests

Estimated Instructional Time:
It is offered to students in eleventh and twelfth grade. It is strongly recommended that students have a basic understanding of advanced mathematics prior to electing this course. This class meets for a minimum of one hundred twenty clock hours for one credit.

Sequence

1. Representing Motion
2. Accelerated Motion
3. Forces in One Dimension
4. Forces in Two Dimensions
5. Motion in Two Dimensions
6. Momentum
7. Energy & Work
8. Heat
9. Waves
10. Sound
11. Light

Technology Integration:
In addition to print resources, students will use technology... (when, why, how???)

- Internet resources to research topics and gather information
- Vernier LabPro probes and software to gather and analyze data
- Excel to graph data and create data sets

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Please place each "big idea" in a new box (i.e. Numbers and Operations – Counting and Cardinality)	What students need to know	What students need to be able to do	Common vocabulary used across curriculum	Relevant content standards	The approximate time that will be spent on the concepts.
Forces and Motion	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.	Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.	force system speed velocity acceleration mass net force vector scalar magnitude causality cause and effect	3.2.9-12.I	1st Marking Period
Forces and Motion	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system	Use mathematical representations of phenomena to describe explanations.	momentum impulse force conservation net force elastic collision inelastic collision system models	3.2.9-12.J	2nd Marking Period
Forces and Motion	Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision.	Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.	force time impulse momentum collision acceleration design	3.2.9-12.K	2nd Marking Period
Definitions of Energy	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.	Create a computational model or simulation of a phenomenon, designed device, process, or system	kinetic energy mechanical energy potential energy energy transfer system conservation of energy first law of thermodynamics system models basic laws	3.2.9-12.O	2nd Marking Period

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
Definitions of Energy	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	energy kinetic energy potential energy conservation of energy first law of thermodynamics models	3.2.9-12.P	3rd Marking Period
Definitions of Energy	Design, build and refine a device that works within given constraints to convert one form of energy into another form of energy.	Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	energy conservation of energy energy transfer mechanical energy kinetic energy potential energy technological systems	3.2.9-12.Q	3rd Marking Period
Conservation of Energy and Energy Transfer	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	second law of thermodynamics thermal energy heat heat transfer systems closed system system models	3.2.9-12.R	4th Marking Period
Wave Properties	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media	Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations.	medium frequency wave wavelength longitudinal wave transverse wave wave speed	3.2.9-12.T	4th Marking Period
Wave Properties	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model and that for some situations one model is more useful than the other.	Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.	electromagnetic radiation wave model of radiation particle model of radiation photon system models	3.2.9-12.V	4th Marking Period

PA Wildlife & Conservation

Statement of Organization:
This course is an introduction to Pennsylvania Wildlife and Conservation. An emphasis is placed on recognizing and identifying species of Pennsylvania mammals, birds, amphibians, reptiles and fish.

Expected Levels of Achievement:
All students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Exams
- Quizzes
- Homework
- Research projects

Estimated Instructional Time:
60 clock hours

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
PA Conservation History	PA resources and conservation	Students will describe the origins of PA conservation groups and resources and their cultural impact on PA citizens	human disturbances	3.1.9-12.N Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity	3 weeks
Mammals	Mammals characteristics and identification of PA mammals	Students will describe characteristics of mammals and identify different examples of PA mammals	group behaviors	3.1.9-12.O Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce	10 weeks
Birds	Birds characteristics and identification of PA birds	Students will describe characteristics of birds and identify different examples of PA birds	evolutionary evidence	3.1.9-12.S Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence	10 weeks
Amphibians & Reptiles	Amphibians & Reptiles characteristics and identification of PA amphibians & reptiles	Students will describe characteristics of amphibians and reptiles and identify different examples of PA amphibians and reptiles	natural selection biological fitness	3.1.9-12.T Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual	10 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
				reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment	
Economics of Wildlife and Conservation	Economic benefits of PA wildlife and natural resources	Students will explore the benefits to PA economy of hunting, fishing and wildlife conservation			3 weeks

Science, Technology & Society

Statement of Organization:
This course requires students to analyze the interdependent relationship between Science, Technology and Society.

Expected Levels of Achievement:
All students are expected to achieve mastery of the skills and concepts taught by obtaining at least eighty percent (80%) on all graded materials and projects.

Methods of Evaluation:
Student competence will be assessed through the use of one or more of the following methods:

- Exams
- Quizzes
- Homework
- Research projects

Estimated Instructional Time:
60 clock hours

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
History of Technology	The decision to develop a new technology is influenced by societal opinions and demands.	Address real-world issues with multiple facets and potential solutions that require careful consideration of various factors. Identify and analyze the different groups affected by a proposed solution, including their potential concerns and interests.	Industrial Revolution innovation invention artifact tool mechanical device engineering obsolete tech advancement	3.5.9-12.F Evaluate how technology and engineering advancements alter human health and capabilities. 3.5.9-12.H Evaluate ways that technology and engineering can impact individuals, society, and the environment. 3.5.9-12.HH Analyze how the Industrial Revolution resulted in the development of mass production, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.	4 weeks
Energy Resources & Environmental Science	That developing a solution to a technological problem can have negative environmental and social impact.	Engage in discussions about complex issues like climate change mitigation strategies, nuclear power plant development, or genetically modified organisms, weighing	fossil fuels nuclear renewables electricity solar	3.5.9-12.B Critically assess and evaluate a technology that minimizes resource use and	6 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		various perspectives and potential impacts. Design a sustainable energy system for a community, considering factors like cost, environmental impact, and efficiency. Analyze the potential social and environmental impacts of a new energy source like nuclear power.	wind water geothermal biomass nuclear	resulting waste to achieve a goal. 3.5.9-12.C Develop a solution to a technological problem that has the least negative environmental and social impact.	
Food & Agriculture Technology	Assessing technological products, systems, and processes through critical analysis of their impacts and outcomes.	Analyze potential solutions to a local water pollution issue, evaluating each option based on cost, effectiveness, and potential environmental impacts. Debate the ethical considerations surrounding genetically modified organisms (GMOs) in agriculture	farming cultivation horticulture gardening husbandry agribusiness agronomy hydroponics	3.5.9-12.D Critique whether existing or proposed technologies use resources sustainably. 3.5.9-12.S Conduct research to inform intentional inventions and innovations that address specific needs and wants.	6 weeks
Medical Technology	Disparities in the technologies available to different groups of people have consequences for public health and prosperity.	Analyze real-world scenarios like the development of a new medicine, the construction of a dam, or a proposed energy project, evaluating the potential benefits and drawbacks considering social, economic, and environmental factors. Debate the pros and cons of different medical treatments, taking	vaccination organ donation organ transplantation bacteria virus Covid EKG sonogram MRI CAT scan	3.5.9-12.E Evaluate how technology and engineering advancements alter human health and capabilities. 3.5.9-12.G Evaluate a technological	6 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
		into account factors like efficacy, side effects, and cost		innovation that was met with societal resistance impacting its development 3.5.9-12.GG Evaluate how technology and engineering have been powerful forces in reshaping the social, cultural, political, and economic landscapes throughout history.	
Construction Technology	Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	Design and evaluate solutions to problems like building a sustainable bridge, designing a cost-effective solar panel system, or creating a safe and efficient vehicle, considering factors like materials, cost, and environmental impact. Conduct a cost-benefit analysis for a proposed engineering project, considering safety concerns and aesthetic considerations. Evaluate the impact of a proposed infrastructure project on local communities and the environment.	Anchor Bolts Apron Back Fill Backing Framing Bay Beam Bearing wall Blocking	3.5.9-12.M Develop a device or system for the marketplace. 3.5.9-12.P Apply a broad range of design skills to a design thinking process. 3.5.9-12.U Evaluate and define the purpose of a design	6 weeks
Nanotechnology	Use evidence to better understand and solve problems in technology and engineering, including applying computational thinking.	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	Nanotechnology Nanometer Microtechnology Atom Bulk technology Carbon	3.5.9-12.CC Analyze how technology transfer occurs when a user applies an existing innovation developed	4 weeks

Big Idea/Reporting Category	Concepts/Standards	Competencies/Eligible Content	Vocabulary	Standards	Pacing
			Nanotubes Cell pharmacology Cell surgery	for one function for a different purpose 3.5.9-12.FF Evaluate how technology enhances opportunities for new products and services through globalization.	
Forensic Science	Develop a process or system with interacting components and criteria	Eefine a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.		3.5.9-12.DD Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system. 3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work.	4 weeks