

Science Curriculum

Explanation of Terms

Alaska Science Standards

Science Standards were adopted by the State Board of Education in 2019. These are general statements of what Alaskans want students to know and be able to do as a result of their public school experience. <https://education.alaska.gov/standards>

Alaska Cultural Standards

Standards endorsed by the State Board of Education that serve to encourage enrichment of the content standards. They are used as a guide to ensure that schools are aware of and sensitive to their surrounding physical and cultural environments.

<https://education.alaska.gov/akstandards/#c3gtabs-cultural>

Objectives

Statements that document specific, essential tasks students are expected to accomplish in a given grade level or course.

Guaranteed and Viable Curriculum (GVC)

A guaranteed and viable curriculum is one that guarantees equal opportunity for learning for all students. Similarly, it guarantees adequate time for teachers to teach content and for students to learn it. A guaranteed and viable curriculum is one that ensures that the curriculum being taught is the curriculum being assessed. It is viable when adequate time is ensured to teach all determined essential content.

Standards Alignment Coding

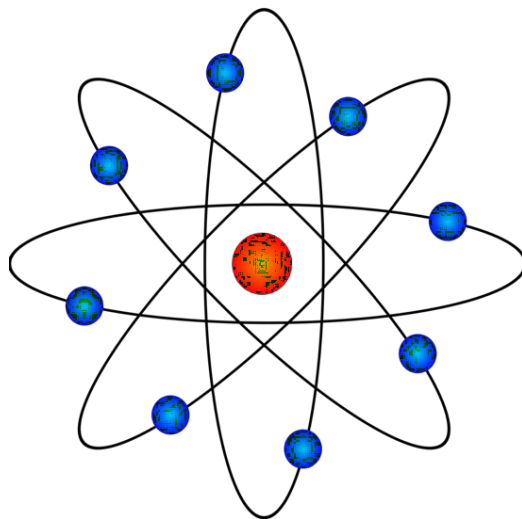
This Science Curriculum is aligned to the Alaska Science Standards adopted in 2019, which are largely the same as the national Next Generation Science Standards (NGSS). The Alaska Science Standards provide a foundation for defining what students should know and be able to do in terms of scientific knowledge and skills.

(<https://education.alaska.gov/akstandards/science/science-standards-for-alaska.pdf>)



Science Standards for Alaska Disciplinary Core Ideas	
Physical Sciences PS1: Matter and its interactions PS2: Motion and stability: Forces and interactions PS3: Energy PS4: Waves and their applications in technologies for information transfer	Life Sciences LS1: From molecules to organisms: Structures and processes LS2: Ecosystems: Interactions, energy, and dynamics LS3: Heredity: Inheritance and variation of traits LS4: Biological evolution: Unity and diversity
Earth and Space Sciences ESS1: Earth's place in the universe ESS2: Earth's systems ESS3: Earth and human activity	Engineering, Technology, Applications of Science ETS1: Engineering design

High School Science Courses



Grades 9-12

Science Graduation Requirements

The student must complete a total of three credits (six semesters) of high school science courses to include:

- 1.0 credits of Life Science
- 1.0 credits of Physical Science
- 1.0 credits of Science electives

Life Science Options	Physical Science Options	Science Electives
• <i>Alaska Zoology: Fish and Birds</i> • <i>Alaska Zoology: Mammals</i> • <i>AP Biology</i> • <i>AP Environmental Science (semester 1)</i> • <i>Biology or Honors Biology</i> • <i>Environmental Science (semester 1)</i> • <i>Human Anatomy and Physiology</i> • <i>Marine Science</i> • <i>Wildlife Biology</i>	• <i>AP Chemistry</i> • <i>AP Environmental Science (semester 2)</i> • <i>AP Physics 1</i> • <i>AP Physics 2</i> • <i>AP Physics C: Mechanics</i> • <i>Chemistry</i> • <i>Earth & Space Science</i> • <i>Environmental Science (semester 2)</i> • <i>Geology</i> • <i>Physical Science</i> • <i>Physics</i>	• <i>Astronomy</i> • <i>Forensic Science 1</i> • <i>Forensic Science 2</i> • <i>Introduction to Basic Pathophysiology</i> • <i>Paleontology</i> • <i>Any course from the Life Science and Physical Science lists.</i> • <i>CTE Courses:</i> - o <i>Advanced Automotive Technology 1B (second semester)</i> - o <i>Engineering Design and Development B</i> - o <i>Introduction to Exercise Science and Sports Medicine 1B</i> - o <i>Medical Terminology</i> - o <i>Pharmacy Technician 1B</i> - o <i>Principles of Engineering A/B</i>

Life Science

Introduction to Environmental Science

Grade(s): 11-12 Length: two semesters Credit: 1.0 (4.0 college credits)* Prerequisites: Teacher recommendation or <i>Biology</i>, and <i>Chemistry</i> Textbook: Pearson <i>Environmental Science</i> This course can be taught as a high school science course or for college credit. College credit is incumbent on the incorporation of a lab section that requires students to complete 10 lab-based activities over the course of the school year. In the past, this course has used online-lab resources purchased through ScienceInteractive: https://www.scienceinteractive.com/www.scienceinteractive.com/	Course Overview: Introduction to Environmental Studies is designed to be equivalent to a one-semester, introductory college course, through which students engage with the scientific principles, concepts and methodologies required to understand the interrelationships of the natural world. Environmental science is an interdisciplinary subject that embraces various topics including geology, biology, ecology, hydrogeology as well as earth and atmospheric science. The course requires that students identify and analyze natural and human made environmental problems at the local level, evaluate the relative risks associated with these problems and examine alternative solutions for resolving or preventing these issues. This can be taught as a lab based course where each lab is designed to help reinforce concepts and skills that are addressed in class. Students will complete up to 10 labs throughout the school year and will be asked to work independently as well as collaboratively in groups. This course integrates two significant activities each semester. The Strait Science Lecture Review will engage students in primary resources as they analyze and discuss Strait Science lectures on a variety of environmental topics. Strait Science is a local lecture series organized by Northwest Campus that invites researchers to discuss local projects ongoing in the region with community members. Strait Science lectures viewed in class will be relevant to course content and encourage students to reflect on the scientific process as they identify the research objective and hypotheses, discuss project methods as well as analyze the significance of the results presented in the lecture. Students will discuss the significance of the research to their community and region, delineate questions that they would like answered on the topic and note any biases that may be present in the research. In addition, students will work collaboratively with classmates to research local environmental issues for the Stewards of Our Land project. The objective of this project is to familiarize students with local issues related to renewable energy sources and mining operations so that students may brainstorm ways to inform the community on complex issues as well as provide strategies to ameliorate negative impacts on the environment. Projects may include discussions of environmental topics through the local radio station, publish articles in the school and local newspaper, and/or construct project proposals that may be discussed with local leaders in order to discuss possible solutions that may resolve issues we currently face in Nome.
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Units(Recommended Order)	
Semester 1	Semester 2
Traditional Teaching Method: • Introduction to Environmental Science • Biosphere • Atmosphere	Traditional Teaching Method: • Atmosphere (continued) • Geosphere • Hydrosphere

Unit 1: Introduction To Environmental Science					
	Suggested Pacing: 4 weeks				
Standards	Knowledge and Skills (Key Objectives)	Essential Question(s)	Objectives	Cultural Activities	Suggested Activities & Resources
	Investigation One 1.Introduction to Environmental Science (pp 4-11 and 228-241) Vocabulary: Environment, environmental science, ecology, environmental activism, natural resource, renewable natural resource, nonrenewable natural resource, sustainable, fossil fuel, ecological footprint - Environmental scientists study how the natural world works, and how humans and the environment affect each other. - In the last several hundred years, both human population and resource consumption have increased dramatically.	1.How does environmental science help us understand the natural world?	- Explain the focus of environmental science - Describe the recent trends in human population and resource consumption		Core Activities - Ecological Footprint Activity and bookmark (Suburban Science) - Communal Resource Activity (Suburban Science) OR - Tragedy of the Commons (hands-on activity)- Quiz: Google Form Link https://forms.gle/fC7Ah4TVmQ5X5vfM6
	Investigation Two 1.Nature of Science Vocabulary: hypothesis, prediction, independent variable, dependent variable, controlled study, data 2.The Community of Science 3. Strait Science Lecture Review: Spectacular Shorebird Migration 4.Evaluating Energy Facts Vocabulary: Claim of fact, expert, credible source, lateral reading Facts support informed decision-making by leading to more accurate predictions about the likely outcomes of different choices.	1.What is science? 2.What happens to a scientific study after data have been gathered and the results are analyzed? 3. What scientific research is being done in our region? 4. How can we	- Explain what science is. - Describe the major roles of the scientific community in the process of science. - Identify the different steps of the scientific process while viewing a Strait Science lecture. - Distinguish Facts		Core Activities - Evaluating Energy Facts Investigation- Teacher Edition - Evaluating Energy Facts investigation- Student Edition - Strait Science Lecture Review: Spectacular Shorebird Migration worksheet (worksheet in activities folder) - Lecture Found here: https://www.youtube.com/watch?v=vqkqNXmNjV&list=PLuugkhFcq8ifdnRxDaKYiRiewrQSvzcA6&index=18 Optional Activities - Environmental Scientist Research (Suburban Science) - Create Your Own Environmental

	Unit 1 Project *(Optional) Straight Science Lecture Review: Seabirds and the Changing Northern Bering Sea *COASST (Coastal Observation and Seabird Survey Team): Citizen Science	1.How does COASST and citizen science contribute to the monitoring of our local seabird populations?	- Identify beached birds using the COASST Beached Birds field guide - Analyze data from COASST from around the region and lectures presented in class to explain recent seabird deaths with previous die-off events - Define key terms discussed in the readings with peers	Strait Science Lecture Review_ Searbirds and the Changing Northern Bering Sea Strait Science Presentation: https://www.youtube.com/watch?v=vqkqNXmNjVk&list=PLuuqkhFcq8ifdnRxDaKYiRiewrQSvzcA6&index=17 - COASST Seabird Monitoring Project About: https://coasst.org/about/ Watch following videos related to COASST Bird Survey (Project) - Link to COASST data sheets: https://coasst.org/toolbox/beached-birds/ - Link to COASST bird measuring video: https://vimeo.com/211755589 - Link to COASST beach measuring video https://vimeo.com/181084689 - Link to COASST paces per meter video: https://vimeo.com/181084699
	Standards List:			

	Unit 2: Biosphere				
	Suggested Pacing: 6-8 weeks				
Standards	Knowledge and Skills (Key Objectives)	Essential Question(s)	Objective(s)	Cultural Activities	Suggested Activities & Resources
	Investigation One- Basics of Ecology Spheres of the Earth (pp72-82 in text) (pp 76-82) Vocabulary: erosion, geosphere, lithosphere, biosphere, atmosphere, hydrosphere, crust, mantle, core, tectonic plate, landform, deposition, evaporation, transpiration, precipitation, condensation, aquifer, groundwater, • An output of one of Earth's systems is often also an input to that or another system • Earth's geosphere, lithosphere, biosphere, atmosphere and hydrosphere are defined according to their functions in Earth's systems • Earth's geosphere consist of the crust, mantle and the core • Earth's biosphere and atmosphere are the living Earth and the ocean of gases that supports and protects it • Water cycles through the lithosphere, biosphere and atmosphere endlessly	1. What types of systems play roles in environmental science? What are systems? What are Earth's spheres? 2.What are the characteristics of Earth's geosphere, biosphere, atmosphere and hydrosphere? What is the geosphere? What is the hydrosphere? What is the atmosphere and biosphere?	• Describe two major ways the Earth's systems interact • Define Earth's geosphere, lithosphere, biosphere, atmosphere and hydrosphere • Describe the parts of the Earth's geosphere • Describe Earth's biosphere and atmosphere. • Discuss the water cycle.		Core Activities • Spheres of Earth's Outdoor Activity- (Suburban Science) Optional Activities • Biome Poster Project (Suburban Science) • Ecology Reading (in Pearson Environmental Science textbook)

	*Studying Ecology (pp. 100-103) (pp. 164-180) (pp 168-178) (pp 133-135) Vocabulary: ecology, species, population, community, ecosystem, biosphere, biotic factors, biosphere, biotic factor, abiotic factor, habitat, resource, biome, climate, weather, climatograph, net primary production, - Ecologists study life at many levels, from individual organisms to the entire biosphere - Ecosystems include both biotic and abiotic factors - Organisms depend on resources provided by their habitat for survival - Biomes are characterized by their climates as well as typical plant and animal life - Biomes vary in their rates of net primary production. Warm and wet biomes have the highest net primary production and cold, dry biomes have the lowest. - Discuss the factors that influence an organism's niche. <i>*Note: This will not address Aquatic Biomes (see Hydrosphere Unit)</i>	1.How do ecologists organize and study life? What is ecology? How are living things organized? How do biotic and abiotic factors differ? Where do organisms spend their time? 2. What abiotic and biotic factors are used to classify biomes? What is a biome? What is primary productivity? 3.What conditions and organisms characterize the world's biomes? 4.How do species interact in nature? What is the difference between habitat and niche? How does energy move through an ecosystem? How do toxins make their way through a food web? 5.What role does the environment play in an organism's	- Describe the different levels of organization studied by ecologists - Explain the difference between biotic and abiotic factors - Discuss how an organism's habitat relates to its survival - Explain how biomes are characterized - Describe how net primary production varies among biomes - Explain how organisms are adapted to the conditions of their biomes - Explain how biotic and abiotic factors influence an ecosystem - Compare habitat and niche - Explain how variation in niche can impact survival and prevent competition for resources between organisms - Identify different trophic levels in a food chain/web - Compare bioaccumulation and biomagnification - Define <i>species</i>, <i>speciation</i>, <i>gene pool</i> and <i>interspecific</i>		Core Activities - Data Analysis: Climatograms (Suburban Science) - Digging Deeper: Vegetation and Climate (Suburban Science) - AAB Biome Activity worksheet - Activity utilizes the following website: askabiologist.asu.edu/explore/biomes - Digging Deeper: Speciation (suburban science) - Interspecific Competition (suburban science) - Digging Deeper: Keystone Species (Suburban Science) - Data Analysis: Indicator species (suburban science) Optional Activities - Biome Poster Project (Suburban Science) - Ecology Reading (in Pearson Environmental Science textbook) Quiz: Google Form Link https://forms.gle/Kw7KSmQtshHKQkeR9
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		survival and reproduction? What is a species? What causes extinction and how are species protected? What is speciation? What causes speciation? What is interspecific competition?	<i>competition</i> • Explain the difference between an endangered vs threatened species • List factors that can lead to the extinction of a species • Compare the four factors that cause speciation • Explain the principle of competitive exclusion		
	Investigation Four-Populations 1.Describing Populations (pp. 104-109) Vocabulary: population size, population density, population distribution, age structure, age structure diagram, sex ratio • The overall health of a population can often be monitored by tracking how its size changes • A population's density is a measure of how crowded it is • Populations can be distributed randomly, uniformly or in clumps • Age structure diagrams show the number of males and females in different age groups within a population 2.Population Growth (pp. 110-117) • A population's growth is determined by births, deaths, immigration and emigration. • Populations can grow exponentially or logistically	1.What are the important characteristics of populations? What is population size? What is population density? What is age structure? 2.What factors determine whether, and how, a population's size changes? What factors effect population growth? How do populations grow?	• Explain the usefulness of tracking population size • Define Population density • Describe the three ways populations can be distributed • Explain what age structure diagrams tell you about a population • Describe the factors that influence a population's growth rate • Explain exponential growth and logistic growth • Explain how limiting factors and biotic potential affect population growth		Core Activities • Describing Populations (Pearson Environmental Science textbook) • Data Analysis: Age Structure Diagram (suburban science) • Data Analysis: Barnacle Geese Population (suburban science) • Real Life Scenario: Ozark Collard Lizzards (suburban science) • Deer Ecology Analysis (Suburban Science) • Digging Deeper: Invasive Species Optional Activities • Biodiversity Lab (suburban science) • Data Analysis: Biodiversity analysis (suburban science) • Population Growth Concept Map (suburban science) • R v K Strategist Card Sort

	- Limiting factors and biotic potential regulate a population's growth. *Biodiversity (pp 200- 211) Biodiversity, species diversity, genetic biodiversity, ecological biodiversity, invasive species - Species diversity, genetic diversity, and ecosystem diversity are all parts of an area's overall biodiversity. - Invasive species is a major cause of biodiversity loss.	3. What is biodiversity? What are 3 main types of biodiversity? How is a biodiversity index calculated? How is the transect line used? What impact do invasive species have on biodiversity?	- Differentiate the components of biodiversity - Explain how biodiversity is calculated and one method used to measure it. - Explain how invasive species leads to biodiversity loss.		<u>Semester 1: Final</u> Located in the Unit 2: Evaluation Folder
	Standards List:				

Unit 3: Atmosphere					
Suggested Pacing: 5 weeks Note: Stewards of Our Land Project will begin at the conclusion of Unit 6 and before S2 Final Exam. This will add approximately 2 weeks to the pacing guide.					
Standard	Knowledge and Skills (Key Objectives)	Essential Question(s)	Objectives	Cultural Activities	Suggested Activities & Resources
	Investigation One: Composition and Layers of the Atmosphere Earth's Atmosphere (pp 452- 459) Vocabulary: atmosphere, relative humidity, air pressure, troposphere, stratosphere, ozone layer, mesosphere, thermosphere, radiation, conduction, convection, convection current, air mass, front - Properties of the atmosphere include its composition, relative humidity, temperature and air pressure - The main layers of the atmosphere are the troposphere, stratosphere, mesosphere and thermosphere - Processes that affect weather in the	1,How can we describe the Earth's Atmosphere? What is the atmosphere made of? How is temperature and pressure measured? How is the atmosphere divided? What are characteristics of the troposphere? What are characteristics with the stratosphere? What are characteristics with the mesosphere?	- Identify the properties of the atmosphere include its composition, relative humidity, temperature and air pressure - Compare the different components of the atmosphere (nitrogen, oxygen, water vapor) - Explain how relative humidity and condensation relate to cloud formation - Identify the different layers of the		Core Activities - Earth's Atmosphere: Reading activity (Pearson Environmental Science textbook) - Data Analysis: Atmospheric Composition (Suburban Science) - Digging Deeper: Ozone Layer (Suburban Science) - Data Analysis: Solar Insolation (Suburban Science) - Layers of the atmosphere: Coloring page worksheet

	converter, scrubber, ozone hole, chlorofluorocarbon (CFC), Montreal Protocol • The Clean Air Act has provisions that have reduced air pollution in the United States • Nations have taken steps to deal with the problems of ozone loss in the stratosphere	3. What measures can limit and prevent pollution of the atmosphere?			
	Investigation Two: Global Climate Change 1.Our Dynamic Climate (pp. 484-490) Climate Change Vocabulary: greenhouse effect, greenhouse gas, thermohaline circulation, El Nino, topography • The heating of Earth's atmosphere by the sun is influenced by the greenhouse effect, latitude, and sunspot cycles • Winds distribute heat and moisture globally • Oceans affect climate by transporting heat and absorbing carbon dioxide • Global climate may be affected by factors such as topography, volcanic eruptions, regional vegetation and changes in Earth's orbit • Evidence of global climate change includes rising atmospheric temperature, precipitation trends, melting ice and rising seas	1.What factors determine Earth's Climate? How does energy from the sun impact the climate? How do oceans affect climate? 2. What evidence shows that climate change is occurring in Alaska and Nome and why it is happening?	• Describe factors that affect how the sun warms Earth • Discuss the role of wind patterns in determining climate • Explain how the oceans affect Climate • Describe how climate is affected by topography, volcanoes, regional vegetation, and periodic changes in Earth's orbit • Identify evidence of global warming • Explain three methods used to study climate change • State the probable cause of global climate change		Core Activities • Digging Deeper: Greenhouse Gasses (Suburban Science) • Digging Deeper: ENSO (Suburban Science) • Digging Deeper: Deforestation (Suburban Science) • Global Climate Change (Pearson Environmental Science textbook) • Newsela article: Climate Change warning is dire • Newsela article: UN Climate Report Key to Action • Our changing Environment: Climate Change Activity Optional Activities • Newsela Article: Ocean Conveyor Belt • Digging Deeper: Carbon Residence Time (Suburban Science) •

*Note: No Formal Presentation on Climate Change/Effects of Climate Change. Slides can be added onto the PowerPoint presentation. Various readings and activities have been provided to supplement this topic. Climate Change (pp. 491- 496) Vocabulary: global climate change, global warming, proxy indicator, climate model, fossil fuel • Evidence of global climate change includes rising atmospheric temperature, precipitation trends, melting ice and rising seas • Scientists study changes in climate by taking direct measurements, inferring past climate characteristics and using models to predict the future • Evidence indicates that global warming has been caused largely by the increase in greenhouse gases in the atmosphere Effects of Climate Change (pp. 497-501) Vocabulary: coral bleaching • As the atmosphere warms, ecosystems on land and in the ocean are changing, affecting organisms in various ways • Global Climate Change is affecting aspects of human life such as farming, forestry, the economy and health • Computer modeling predicts that global climate change will continue to affect people Responding to Climate Change (pp. 502-507) Vocabulary: carbon footprint, carbon tax, carbon offset, carbon sequestration, Kyoto Protocol • As the atmosphere warms, ecosystems on	3.What are the effects of climate change?	• State ways in which the warming atmosphere affects ecosystems and organisms • Explain how climate change is affecting people now • Predict future effects of Climate Change on people • List ways to reduce greenhouse gases related to the use and generation of electricity • Describe some of the ways of reducing greenhouse gases related to transportation • Describe other strategies for reducing greenhouse gases • Explain how nations are working together to try to address Climate Change		
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	land and in the ocean are changing, affecting organisms in various ways • Global climate change is affecting aspects of human life such as farming, forestry, the economy and health • Computer modeling predicts that global climate change will continue to affect people				
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Unit 3: Geosphere

Suggested Pacing: 4 weeks

Note: Stewards of Our Land Project will begin after S1 Midterm Exam. This will add approximately 2 weeks to the pacing guide.

Standards	Knowledge and Skills (Key Objectives)	Essential Questions	Objectives	Cultural Activities	Suggested Activities & Resources
	Investigation Two- Minerals, Rocks and Mining 1.Minerals and Rocks (pp 392-397) Vocabulary: mineral, precipitation, polymorph, rock and rock cycle • A mineral is a naturally occurring, inorganic solid that has an orderly crystalline structure and a definite chemical composition • Minerals can form by crystallization from magma or lava, from precipitation related to evaporation or hydrothermal solutions, or from exposure to high pressure and temperature or they can be produced by organisms • Forces deep inside and at the surface of Earth produce changes in rock that cause the same material to cycle between igneous, sedimentary and metamorphic rocks 2.Mining (pp 398- 404) Vocabulary: ore, strip mining, subsurface mining, open pit mining, mountaintop removal, placer mining, tailings, smelting • Mining companies seek and gather valuable	1.Where do minerals come from? 2.How are mineral resources accessed? 3.How can we reduce the negative impacts of mining and manage mined	• Explain what a mineral is • Describe how minerals form • Identify types of rocks and the stages of the rock cycle •Identify the types of resources that are mined •Describe different methods used for mining •Explain how metals are processed • Describe the negative impacts of mining on the environment and society • Explain how mining		Core Activities • Minerals and Rocks (Pearson Environmental Science textbook) • Mineral social media profile (Suburban Science) • Rockcycle Jigsaw activity (suburban science) • Dimensional Analysis: Coal Mining (Suburban Science) • Digging Deeper: The Mining Process (Suburban Science)

	resources such as metals, nonmetallic minerals and fuel sources • Mining companies have developed many techniques to access resources close the surface of the Earth, deep underground, and even underwater • After mining, ores and other extracted materials are processed to separate the desired materials, combine them with other materials, and alter their properties 3. Mining Impacts and Regulation (pp. 405-411) Vocabulary: acid drainage • Environment impacts of mining include increased erosion, increased sediment and debris, and pollution of water, land and air. Mining can also have negative impacts on society • Regulations that govern mining consider the environment and safely impacts of mining along with the economic costs to the industry • Because minerals are a nonrenewable resource, we need to be concerned about finite supplies and ways to use them more responsibly, such as reusing and recycling.	resources?	is regulated • Describe ways that mineral use can become more responsible		
	Investigation One- Soil Composition + Conservation Soil (pp 352-357 in text) Vocabulary: soil, parent material, bedrock, weathering, soil horizon, soil profile, clay, silt, sand, loam • Soil is a complex substance that forms through weathering, deposition, and decomposition • A soil profile consists of layers known as horizons • Soils can be classified by their color, texture, structure and pH Soil Degradation and Conservation (pp. 358-364) Vocabulary: soil degradation, intercropping, crop	1. What is soil? 2. How do erosion, desertification, and soil pollution affect the productivity of	• Explain three processes by which soil forms • Describe the horizons that make up a soil profile • List the four characteristics used to classify soil • Describe some practices that can lead to soil erosion and some that can		•

	rotation, cover crop, shelterbelt, tilling, terracing, contour farming overgrazing, desertification, irrigation, salinization, pesticide • Describe some practices that can lead to soil erosion and some that can prevent it • Identify the causes and effects of desertification • Discuss the activities of U.S. and international agricultural organizations • Explain how irrigation and pesticide use can cause soil pollution	soil?	prevent it • Identify the causes and effects of desertification • Discuss the activities of U.S. and international agricultural organizations • Explain how irrigation and pesticide use can cause soil pollution		
	<u>Stewards of Our Land Project</u> *Local Mining Research and Communication* At the conclusion of the Mineral Resources and Mining Unit, students will apply their learning to a capstone research project that investigates a local mining operation in Nome, Alaska. Working independently or collaboratively, students will: - Identify the resource(s) being mined at the chosen operation. - Describe the mining method(s) used to extract the resource. - Explain how the resource is processed after extraction. - Analyze the impacts of mining on both the environment and the Nome community, including both positive and negative effects. Students will first submit a formal written report of their research findings. Following this, they will craft a community-focused communication piece designed to share their message about the mining process with a wider audience. Students may choose the medium that best fits their message, such as a radio broadcast, newspaper article, letter to a		1.What specific resources are being mined in Nome, and why are they important locally, nationally, or globally? 2.How is this resource extracted and processed, and what technologies or methods are used? 3.What are the environmental impacts of this mining operation, both immediate and long-term? 4.How does this mining activity affect the Nome community economically, socially, and culturally?		• Guest speakers

	policymaker, or educational content for social media. This project is designed to connect course concepts to real-world issues in our region, promote critical thinking about natural resource use, and empower students to communicate responsibly about environmental topics that affect their community.		5. In what ways can mining practices and resource use become more sustainable and responsible for future generations		
	Standards List:				

Land use and Sustainability Unit (additional Content)					
	Suggested Pacing: 3 weeks				
Standards	Knowledge and Skills (Key Objectives)	Essential Question(s)	Objectives	Cultural Activities	Suggested Activities & Resources
	Investigation One: Urbanization Land Use and Urbanization (pp 292 and 298) Vocabulary: land cover, land use, urban area, rural area, urbanization, infrastructure, heat island - Land cover influences land use, and humans change both when they build urban areas - Urbanization occurs when people move out of rural areas toward areas with more or better jobs - Cities have both negative and positive impacts on the environment Sprawl (pp. 299-304) Vocabulary: sprawl - As people move from cities to suburbs, population growth and increased land	1. How do we use the land we live on? 2. How can the effects of	- Differentiate between land cover and land use, and describe how people effect both - Explain how and where urbanization occurs - Describe the environmental impacts of urbanization - Describe the contributors to spiral		- Heat Islands Online Research -Suburban Science - Impacts of Urbanization Poster- Suburban Science - Urban Sprawl Drawing Activity- Suburban Science - Urban Issues in Developing and Develop Countries Research Project- Suburban Science - Be a City Planner Group Activity- Suburban Science Strait Science Presentation Review: Arctic Vessel Traffic Management https://www.youtube.com/watch?v=L1Qss0r2a3A&list=PLuuqk

	consumption per capital contribute to sprawl • Sprawl effects the transportation, pollution, public health, land use and economics of an area Sustainable Cities (pp. 305-313) Vocabulary: city planning, geographic information system (GIS), zoning, urban growth boundary (UGB), smart growth, ecological restoration, greenway • City planners use many tools in the attempt to make urban areas more livable • Transportation options are vital to livable cities • Parks and open space are key elements of livable cities • The goal of a green building is to save energy and other resources without sacrificing people's comfort • There has been promising progress toward urban sustainability	urbanization lead to sprawl? 3. What are the characteristics of a sustainable city?	and its patterns • Explain the impacts spiral has on an area • Describe four different components of city planning • Explain the importance of mass transit option to a city and its residents • Explain the importance of open space to a livable city • Differentiate green buildings from conventional buildings • Discuss the progress towards sustainability some cities have made and its importance to the world •		hFcg8ifdnRxDaKYiRiewrQSvzcA6&index=4
	Investigation Two: Sustainable Agriculture 1.Agriculture (pp. 365-372) Vocabulary: traditional agriculture, yield, industrial agriculture, green revolution, biological pest control, integrated pest management • Agriculture began about 10,000 years ago, when a warmer climate enabled humans to plant seeds and raise livestock • Industrial revolution and the green revolution have saved millions of people from starvation • Chemical pesticides, biological pest control, and integrated pest management can all effectively	1.How has agriculture evolved?	• Discuss the beginnings of agriculture • Explain the importance of industrial agriculture and the green revolution • Identify different types of pest control • Explain the importance of		• GMO Class Debate- Suburban Science • Perplexed by Protein graph interpretation activity - Suburban Science • Informational Flyer on Protein Sources- Suburban Science

	protect crops from pests • Insects and other animals are essential to the reproduction of many crops • 2. Food Production (pp. 373- 383) Vocabulary: arable land, food security, malnutrition, genetic engineering, genetically modified organism (GMO), biotechnology, feedlot, aquaculture, seed bank, sustainable agriculture, organic agriculture • Because hunger continues and the population is growing, we need to find a way to increase food production sustainably • Genetically modified food is a promising way to increase food production, but there needs to be more research into potential risks • Feedlots, aquaculture, and other methods of industrial food production are efficient but they have disadvantages	2. How can we produce enough food for a rapidly growing population while sustaining our ability to produce it?	pollinators to agriculture • Explain why the world needs to grow more food and to grow it sustainably • Discuss genetically modified food • Describe the advantages and disadvantages of industrial food production • Discuss sustainable agriculture		
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Hydrosphere Unit (additional Content)					
	Suggested Pacing: 3 weeks				
Standards	Knowledge and Skills (Key Objectives)	Essential Question(s)	Objectives	Cultural Activities	Suggested Activities & Resources
	Investigation One: Introduction to Water Earth: The Water Planet (pp 420- 425) Vocabulary: fresh water, surface water, runoff, river system, watershed, groundwater, permeable, impermeable, aquifer, water table, recharge zone, well • As a natural resource, fresh water is renewable. However quantities of fresh water on Earth are limited • Surface water is contained within watersheds	1. Where is all of our water?	• Discuss how fresh water can be both renewable and limited • Explain the significance of a watershed • Explain how most groundwater is		• Properties of Water Stations Lab- Suburban Science • Personal Water Audit- Suburban Science • Watershed Mapping Activity- Suburban Science • Building an Aquifer STEM Model - Suburban Science • Irrigation Jigsaw Group Research Activity- Suburban Science

	• Groundwater can be accessed by wells Uses of Freshwater (pp. 426-434) Vocabulary: water diversion, dam, reservoir, salinization, desalination, xeriscaping • Freshwater is used for agriculture, industrial and personal activities • Because of overuse, surface water resources are being depleted • Groundwater is being used, primarily for irrigation, faster than it can be replenished • Addressing freshwater depletion will largely depend on strategies that decrease water demand Water Pollution (pp. 435-443) Vocabulary: point-source pollution, nonpoint source- pollution, cultural eutrophication, wastewater, algal bloom, pathogen, red tide, septic system • There are many different kinds of water pollution, each with its own sources and effects • It can take decades to clean up groundwater pollution, so every effort should be made to prevent it from occurring • Oceans are polluted with oil, toxic chemicals, and nutrients that run off from land • Government regulation and water treatment are two ways of decreasing the effects of water pollution	2. How can we change the way we use water? 3. How does water pollution affect humans and ecosystems?	accessed • List the three primary categories of freshwater use • Related the causes of surface water depletion to their effects • Explain the major causes and effects of groundwater depletion • Describe strategies for addressing water depletion • Discuss the main categories of water pollution • Explain why groundwater pollution is difficult to clean up • Discuss the sources and effects of major pollutants found in the ocean • Describe how water is regulated and treated	• Salination Investigation Lab-Suburban Science •
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	Investigation Two: Aquatic Ecosystems 1.Agriculture (pp. 181-191) Vocabulary: salinity, photic zone, aphotic zone, benthic zone, littoral zone, limnetic zone, wetland, flood plain, estuary, upwelling • Ecologists classify aquatic ecosystems according to criteria such as salinity, depth, and whether the water is flowing or standing • Standing freshwater ecosystems include ponds, lakes, inland seas and wetlands. Flowing freshwater ecosystems include rivers and streams. • Estuaries are home to diverse ecosystems that prevent soil erosion and flooding • The ocean can be divided into three zones based on their distance from shore: intertidal, neritic and open ocean	1.What conditions and organisms characterize the world's aquatic ecosystems?	• Describe the criteria ecologists use to classify aquatic ecosystems • List the major categories of freshwater ecosystems • Explain the ecological importance of estuaries • List the three major zones of the Ocean	• Group Discussion-Commercial Fishing and Aquaculture: Suburban Science • Research a Fish Project- Suburban Science • Oil Spill Clean-up Simulation Lab: Suburban Science • Effects of Oil on Marine Life Research Activity: Suburban Science • Sources of Water Pollution Card Sorting Activity: Suburban Science • Strait Science Presentation Review: Point Lay Walrus https://www.youtube.com/watch?v=MWtd1ciF-lo&list=PLuugkhFcq8ifdnRxDaKYiRiewrQSvzcA6&index=18
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Foundations of Life Science

Grade(s): 9-12 Length: two semesters Credit: 1 Prerequisites: Teacher recommendation	Course Overview: <i>Foundations of Life Science</i> is a one-year course (1-credit) that meets a core-science requirement for graduation. This class is designed with interactive investigations that dive into the topics related to fisheries and arctic gardening practices. During the first semester, students will learn how to raise pacific salmon (Coho) in a classroom incubator from the egg to fry stage under the supervision of the Norton Sound Economic Development Corporation (NSEDCC) fisheries biologists and technicians. Through hands-ons projects and activities, students will study topics about the life cycle, habitat requirements, and behavior/ physical adaptations of salmon before releasing their fry in Moonlight Springs at the end of the school year. Second semester, the class will switch gears and focus on plants and arctic gardening through the development of an indoor vegetable garden. Cheryl Thompson will help supervise indoor garden activities and assist students as they transfer their knowledge through activities at the Community Garden. Throughout Semester 2, students will learn about the diversity, reproductive strategies and physiology of plants. Over the course of the year, students will also discuss local employment opportunities in fisheries available to them after high school as well as discuss and implement a business plan that utilizes the resources from their school vegetable garden. Adopted Textbook To be Determined. (Used to develop this curriculum: <i>Environmental Science</i>. National Geographic, 2022)
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Units (Recommended Order)	
Semester 1	Semester 2
• Introduction: Nature of Science • Fisheries Management • Classroom Gardening	• Classroom Gardening/Fisheries Management (ongoing)* • Wildlife Management *Place-based Projects: Raising Salmon in the Classroom and Gardening will continue until the end of S2

UNIT 1: Nature of Science					
Suggested Pacing: 1 week					Textbook Chapter(s)/Lessons: Chapters 1 and 18
Standards	Knowledge and Skills	Essential Questions	Objectives	Cultural Activities	Suggested Activities & Resources
	Investigation: What is Science? Vocabulary: science, evidence, hypothesis, data, theory	1.What is the natural world?	• Be able to define science, evidence, hypothesis, data, theory • Be able to explain that the natural world is everything that can be perceived with our senses • Be able to identify the 5 major characteristics of science.		Core Activities • Outdoor Observation Assessment • What is Science? Poster Project
Standards List:					

UNIT 2: Fisheries Management					
Suggested Pacing: 16 weeks					Textbook Chapter(s)/Lessons:
Standards	Knowledge and Skills	Essential Questions	Objectives	Cultural Activities	Suggested Activities & Resources
	Investigation 1: Raising Salmon in the Classroom Thermal units, Alevin, fry, smolt, Eyed stage, pH, chlorine, dissolved oxygen • Salmon are an important natural resource, and understanding their life cycle helps people make informed decisions about conservation and habitat protection • Successful fish rearing depends on technology and equipment that replicate the environmental	1.How can we raise salmon in the classroom? -What materials and supplies do we need to incubate our own salmon eggs? - How does chlorine, temperature, and dissolved oxygen affect salmon eggs and alevin? How can we measure these elements?	• I can explain the purpose of raising salmon in the classroom and describe why protecting salmon and their habitats is important. • I can identify the equipment used in classroom salmon incubator and explain how each part helps keep salmon eggs healthy. • I can describe the four critical elements needed for salmon egg development and explain how they affect		Core Activities <i>Investigation 1</i> • Student Reading: Salmon Guide Research Question worksheet • Project: Raising Salmon in the Classroom Guide • Salmon Guide Review worksheet Core Project <i>Investigation 1 (Summative Assessment)</i> • Project_Guide to Raising Salmon in the Classroom (digital booklet to be shared with class) • Salmon Guide Review worksheet Optional Project

	conditions salmon need to survive. • Salmon survival depends on specific environmental conditions, and changes in these conditions can impact development and health. • Effective fisheries management requires consistent monitoring, observation, and responsible stewardship • Scientists use data and environmental measurements to predict growth, development, and life-cycle events in fish populations • Maintaining water quality is essential for healthy aquatic ecosystems and the successful development of fish • Different stages of salmon development have unique needs, and careful management increases survival rates.	- What are ATU's and when do we predict our fish to reach the eyed phase? When will they hatch?	survival and growth. • I can explain the daily responsibilities required to monitor a salmon incubator and maintain healthy conditions for eggs and fry. • I can explain how accumulated thermal units (ATUs) are used to track and predict salmon egg development • I can describe the steps of a weekly water exchange and explain why water quality is important for salmon survival. • I can identify the eyed-egg stage and explain why removing dead eggs is important for maintaining healthy salmon development. • I can describe the characteristics and needs of alevins and explain how their behavior helps them survive in nature. •		<i>Salmon Canning Project</i> The salmon canner is located in the “fish-lab” of the cultural arts room. The smokehouse is located in the parking lot outside of the Cultural Arts room. In the past we have cut, smoked and canned salmon over the course of a week. Community members are invited to assist in the various steps of the process. It requires advanced planning since activities are conducted during this class period. This project also requires various materials/supplies for each step including: filet knives, propane gas, mason jars, brown sugar, salt, salmon filetes, etc. Contacts: Pat Callahan (Activity Director) for assistance with coordinating activity: 907-434-1236; pcallahan@nomeschools.org Tyler Rhodes, NSEDC: Fish donations tyler@nsedc.com Sigvanna, Kawerak: Can provide assistance with activities. 360-980-0926 Sigvanna@kawerak.org • Salmon Canning Journal (student and teacher editions)
	Investigation 2: Managing Salmon in Nome	2. What salmon rehabilitation efforts are being done in the Norton Sound Region? -Who are the people involved in these			

		rehabilitation projects and what are their responsibilities? -What projects are being implemented by NSEDC to manage salmon in the region? -How are egg takes conducted?			

UNIT 4: HUMAN POPULATIONS	
Suggested Pacing: 4-5 weeks	Textbook Chapter(s)/Lessons:
Key Objectives	Suggested Activities & Resources
- Describe how technological advances have contributed to human population growth - Explain recent trends in population growth - Describe total fertility rates and replacement fertility - Explain how the age structure and sex ratio of a population define its potential for growth	ESRI GeoInquiries
- Identify characteristics of human population that are studied by demographers - Describe the demographic transition - Discuss social factors that affect population - List the types of environmental health hazards	

• Describe how humans impact their environments • Compare and contrast epidemiology and toxicology • Discuss risk assessment • Describe how infectious diseases spread • Explain why emerging diseases are important to monitor and control • Differentiate between social hazards that are lifestyle choices and those that cannot be controlled	
Standards List:	GLEs: S.A.1- , Using Mathematics and Computational Thinking, Constructing Explanation and Designing Solutions, LS2.A: Interdependent Relationships in Ecosystems, LS2.C: Ecosystem Dynamics, Functioning and Resilience, ESS3.A: Natural Resources

UNIT 5: PHYSICAL SYSTEMS IN ENVIRONMENTAL SCIENCE	
Suggested Pacing: 4-5 weeks	Textbook Chapter(s)/Lessons: Chapter 3
Key Objectives	Suggested Activities & Resources
• State the definition of an environmental system and give examples • Explain that the geosphere, biosphere, atmosphere, and hydrosphere are defined according to their functions Earth's systems • Explain the importance of the cycling of nutrients, both macro and micro to all life on Earth	• Selected chapters and data-based activities from the “Earth Exploration Toolbook” • HHMI BioInteractive: “Understanding Global Change” Interactive
• Identify the layers of the atmosphere in the correct order • Explain how the ozone layer protects us from harmful ultraviolet radiation	
• Connect plate tectonics to environmental science concepts such as biogeochemical cycles, volcanoes and air pollution, geothermal energy, earthquakes, and risk assessment	
Standards List:	GLEs: S.A.1- , Developing and Using Models, Using Mathematics and Computational Thinking, LS2.B: Cycles of Matter and Energy Transfer in Ecosystems, LS2.C: Ecosystem Dynamics, Functioning and Resilience, ESS2.A: Earth's Materials and Systems, ESS2.B: Plate Tectonics and Large Scale System Interactions

UNIT 6: CLIMATE SCIENCE	
Suggested Pacing: 4-5 weeks	Textbook Chapter(s)/Lessons:
Key Objectives	Suggested Activities & Resources
• Distinguish between weather and climate and list the factors that affect them • Use conduction, convection, and radiation to explain how heat is transferred in the environment • Explain the reason for the seasons	• Selected chapters and data-based activities from the “Earth Exploration Toolbook” • HHMI BioInteractive lesson: “Trends in Atmospheric Carbon Dioxide” • PBS Lab: “Seasons on Earth” • Earth Labs: “Greenhouse Gas Lab”

- Identify greenhouse gasses and their sources - Explain how scientists study changes in climate - Describe the evidence indicating that global warming has been caused largely by the increase in greenhouse in the atmosphere	- Data Nuggets lab on tree ring analysis: “A Window Into a Tree’s World” - SPRINTT Climate Change Curriculum - Project Learning Tree Unit: “Southeastern Forests and Climate Change” - Documentary Film Cosmos Episode 12: “The World Set Free”
Standards List:	GLEs: S.A.1- Planning and Carrying Out Investigations, Asking Questions and Defining Problems, Analyzing and Interpreting Data, ESS2.D: Weather and Climate, ESS3.D: Global Climate Change

Suggested Pacing: 3 weeks	Textbook Chapter(s)/Lessons: Chapters 11, 12, and 13
Key Objectives	Suggested Activities & Resources
- Explain why agricultural lands can lose productivity over time as nutrients are consumed and what are current soil conservation methods - Describe human practices that may lead to soil erosion and techniques that can mitigate it	- Selected chapters and data-based activities from the “Earth Exploration Toolbook” <i>Alaska Resource Education Curriculum:</i> “The Story of Alaska’s Mineral and Energy Resources” Virtual Tour of Copper Mine Project Wet Activities - see website to access guides and resources - Documentary Film: The Last Mountain - Case Study: The Poopin Composting - CaseStudy: “The Wealth of Water”
- Describe the most common methods of mining and their environmental consequences - Describe how different minerals are formed and are cycled through the Earth - Identify mineral resources available in Alaska and how their mining affects humans and the environment, including mining regulations	
- Identify how water is used in society and how water use affects ecosystems.(agricultural, industrial, residential, recreational) - Explain what a watershed is and give an example local to Fairbanks - Identify the distribution of water on Earth. (surface, groundwater, icecaps, ocean)	
Standards List:	GLEs: S.A.1- Planning and Carrying Out Investigations, Constructing Explanations and Designing Solutions, ESS3.A: Natural Resources, ESS2.E: Biogeology, ESS3.C: Human Impacts on Earth Systems

Biology

Grade(s): 9-12 Length: two semesters Credit: 1 Prerequisites: Teacher recommendation, Freshman entry- level class	Course Overview: <i>Biology</i> is a one-year course (1 credit) designed to meet the Biological Science Requirements for graduation. Students will engage in the practices of science to help them understand how scientific knowledge develops as well as gain an appreciation for the wide range of approaches used to investigate, model and explain the world. Such practices will include learning how to develop and use models, planning and carrying out investigations, analyzing and interpreting data as well as engaging in argument from evidence. Academic content will focus on core ideas that will help students develop a broader and deeper understanding of content so that it can be used to make sense of new information and resolve authentic problems. First semester will begin with the Nature of Science, transition into the Cells: Structure and Function concluding with Ecosystem Dynamics. Second semester will focus on Chemistry of Life, Genetics: Inheritance and Variation of traits and will conclude with Evolution and Natural Selection. Adopted Textbook: <i>Biology</i> , Miller and Levine
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Units (Recommended Order)	
Semester 1	Semester 2
Traditional Teaching Method: • The Nature of Science • Strutcure of Life: From Cells to Organisms • Ecosystem Dynamics* *This unit can be taught in the fall or spring to allow for place-based lessons.	Traditional Teaching Method: • Chemistry of Life • Genetics: Inheritance and Variation • Evolution and Natural Selection *This unit can be taught in the fall or spring to allow for place-based lessons.

Unit 1: Nature of Science	
Suggested Pacing: Intermixed through other units	Textbook Chapter(s)/Lessons: Africa Storyline and Homeostasis Storyline
Key Objectives	Suggested Activities & Resources
• Be able to define: Science, scientific theory, evidence, data, hypothesis, independent variable, dependent variable • Be able to develop a model by labeling various parts of a compound light microscope • Be able to	• Macromolecules in Food Lab • Ocean Acidification Lab • Elephant Poop Lab
• Use graphical techniques to describe data. • Use mathematical and/or computational representations of phenomena or design solutions to support explanations. • Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. • 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.	• Labs that incorporate quantitative data • Examples: Pendulum Lab, Zookeeper Nutrition Lab, Elephants Population Lab, Calculating Evolution Lab
• Critically review current literature about scientific topics. • Practice formulating logical conclusions. • Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. • 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.	• Practice writing Claim Evidence Reasoning (CER) reports
Standards List:	GLEs: S.A.1-, Developing and Using Models, Planning and Carrying Out Investigations, Constructing Explanations and Designing Solutions, Using Mathematics and Computational Thinking, Engaging in Argument from Evidence, Asking Questions and Defining Problems, Analyzing and Interpreting Data, Obtaining, Evaluating, and Communicating Information

UNIT 2: Ecology- Ecosystem D This unit can be taught in the fall or spring to allow for place-based lessons.	
Suggested Pacing: 4-6 weeks	Textbook Chapter(s)/Lessons: Africa Storyline , Homeostasis Storyline , and Melanin Storyline
Key Objectives	Suggested Activities & Resources
• Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem (e.g., carbon, energy, water). • Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. • Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	• Model ecosystem energy transfers. • Make posters of food webs/chains from local habitats. • Describe specific ways in which indigenous people use local species. • Individual research projects on local plants and animal species. • Arctic Ecosystems Lab • Africa Storyline, Homeostasis Storyline, and Melanin Storyline
• Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales, specifically in Alaskan ecosystems. • Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. • Describe symbiotic interactions between organisms in a community.	• What Happened to the Otters Lab • Carrying Capacity Lab • Africa Storyline, Homeostasis Storyline, and Melanin Storyline
• Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. • Use food webs of local plant and animal species that show ecological relationships • 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. • evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.	• Use web-based data to graph the extent of sea ice in the Arctic Ocean since 1970. • Explore the causes of that change and its consequences on the organisms of the Arctic. • Invasive plant studies. • Discussions of current ecological issues. • Ocean Acidification Lab • Africa Storyline, Homeostasis Storyline, and Melanin Storyline
Standards List:	HS-LS2: Ecosystems: Interactions, Energy, and Dynamics , LS2.A: Interdependent Relationships in Ecosystems, LS2.B: Cycles of Matter and Energy Transfer in Ecosystems, LS2.C: Ecosystem Dynamics, Functioning, and Resilience, HS-LS4: Biological Evolution: Unity and Diversity , LS4.D: Biodiversity and Humans, GLEs: SC.2-3

UNIT 2: CHEMISTRY OF LIFE	
Suggested Pacing: 4-6 weeks	Textbook Chapter(s)/Lessons: Africa Storyline and Homeostasis Storyline
Key Objectives	Suggested Activities & Resources
Describe and model the basic atomic structure.	- PhET Digital Lab on Atoms Elements & Compounds - Animal Digestion Lab
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.	- Flow chart-type drawings of cellular respiration. - Cellular Respiration Lab - Africa Storyline and Homeostasis Storyline
Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.	- Flow chart-type drawings of photosynthesis. - Understanding Photosynthesis Activity - Africa Storyline and Homeostasis Storyline

UNIT 3: CYTOLOGY	
Suggested Pacing: 4-6 weeks	Textbook Chapter(s)/Lessons: Africa Storyline , Homeostasis Storyline , and Melanin Storyline
Key Objectives	Suggested Activities & Resources
Describe cell organelles and their functions. Systems of specialized cells within organisms help them perform the essential functions of life.	- Models of plant and animal cells. - Microscope skills labs including wet mounts of plant and animal cells and cell drawings. - Africa Storyline, Homeostasis Storyline, Melanin Storyline
Describe diffusion and osmosis and the importance of these processes for cells.	- Predictions and tests of the behavior of cells in salt solutions and distilled water. 3D molecular models of diffusion and osmosis. - Computer animations of diffusion and osmosis. - Student-built models of DNA. - Labs examining the diffusion of materials into different sized objects. - Ocean Acidification Lab - Africa Storyline, Homeostasis Storyline, Melanin Storyline

• Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. • Describe the process of cell division and its role in reproduction and multicellular organisms (mitosis and meiosis).	• Use a cell model to work through all the steps of mitosis and meiosis. • Africa Storyline, Homeostasis Storyline, Melanin Storyline
Standards List:	HS-LS1: From Molecules to Organisms: Structures and Processes, LS1.A: Structure and Function, LS1.B: Growth and Development of Organisms

UNIT 4: GENETICS AND HEREDITY	
Suggested Pacing: 3-5 weeks	Textbook Chapter(s)/Lessons: Africa Storyline , Melanin Storyline , and Disease Storyline
Key Objectives	Suggested Activities & Resources
• Recognize that cells use DNA to store information and manage cellular functions. • Describe the role of chromosomes in sex determination.	• Student-built models of DNA. • Africa Storyline, Melanin Storyline, and Disease Storyline
• Make and defend a claim based on evidence that inheritable genetic variations may result from: (a) new genetic combinations through meiosis, (b) viable errors occurring during replication, and/or (c) mutations caused by environmental factors. • Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	• Human traits activity. • Punnett squares activity. • Lulu the Lioness Lab • Albinism & Pedigrees Lab • Africa Storyline, Melanin Storyline, and Disease Storyline
• 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. • Explain how cell functions are regulated through changes in protein activity. • Model and interpret basic Mendelian patterns of genetics using Punnett squares, and non-Mendelian patterns (e.g., incomplete, codominance, sex-linked traits).	• Melanin Lab • Central Dogma of Biology Activity • Africa Storyline, Melanin Storyline, and Disease Storyline
Standards List:	HS-LS1: From Molecules to Organisms: Structures and Processes, HS-LS3: Heredity: Inheritance and Variation of Traits , LS3.A: Inheritance of Traits, LS3.B: Variation of Traits, GLEs: SC.1-2

UNIT 5: BIOTECHNOLOGY	
Suggested Pacing: 4-6 weeks	Textbook Chapter(s)/Lessons: Africa Storyline , Melanin Storyline , and Disease Storyline
Key Objectives	Suggested Activities & Resources
- Recognize that cells use DNA to store information and manage cellular functions. - 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.	- Restriction Enzyme Lab - Strawberry Electrophoresis - CRISPR Activity - Africa Storyline, Melanin Storyline, and Disease Storyline
Critically review current literature about scientific topics.	- Research project on current advances in biotechnology - Bioethics Research - Africa Storyline, Melanin Storyline, and Disease Storyline
Standards List:	Engaging in Argument from Evidence, Asking Questions and Defining Problems, Analyzing and Interpreting Data, Obtaining, Evaluating, and Communicating Information, HS-LS1: From Molecules to Organisms: Structures and Processes, LS4.D: Biodiversity and Humans

UNIT 6: EVOLUTION	
Suggested Pacing: 6-8 weeks	Textbook Chapter(s)/Lessons: Africa Storyline , Homeostasis Storyline , Melanin Storyline , and Disease Storyline
Key Objectives	Suggested Activities & Resources
- Utilize tools to categorize organisms (i.e., taxonomic keys, cladograms). - Describe the characteristics of domains and kingdoms of organisms. - Within each kingdom, describe how the anatomical characteristics can affect an organism's survival. - Explain the relationship between structure and function in major phyla. - Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. - Describe classification based on evolutionary relationships.	- UC Berkeley Evolution website: http://evolution.berkeley.edu. - Natural selection simulations. - Build a bird. - Africa Storyline, Homeostasis Storyline, Melanin Storyline, and Disease Storyline

• Describe the changes that have occurred over geologic time. • Chronicle the development of evolutionary theory by natural selection. • Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence (homologous structures, embryology, DNA, adaptive radiation, fossil record). • Construct an explanation based on evidence for how natural selection leads to adaptation of populations. • Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) the change in allele frequency within the population, (2) the emergence of new species over time, and (3) the extinction of other species. • Explain how variation within a species and natural selection could result in speciation or extinction. • Create or revise a simulation to test a solution to mitigate adverse impacts on human activity on biodiversity.	• Fossil building simulations. • Interpretation of fossil exercises. • Geological Time activities • Elephant Forensics Lab • Africa Storyline, Homeostasis Storyline, Melanin Storyline, and Disease Storyline
• Explain how the diversity of life has arisen through evolutionary processes. • Describe how variation within species is maintained over time through recombination and mutations of genes. • 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. • 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.	• Peppered Moth activity. • Rock Pocket Mice activity. (HHMI) • Toothpick Fish. • What Happened to the Elephants Lab • Melanin Lab • Evidence for Skin Selection Lab • Africa Storyline, Homeostasis Storyline, Melanin Storyline, and Disease Storyline
Standards List:	HS-LS4: Biological Evolution: Unity and Diversity, LS4.A Evidence of Common Ancestry and Diversity, LS4.B: Natural Selection, LS4.C: Adaptation, LS4.D: Biodiversity and Humans, HS-LS1: From Molecules to Organisms: Structures and Processes, LS1.A: Structure and Function, GLEs: S.A.1; SC.1-2; SG.1-3