Lindenwold Public Schools

Environmental Science Unit 6: Energy - Renewable and Nonrenewable

25 instructional days

Content Standards

HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and [changes in] climate change have influenced human activity. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.]

HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. [Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]

HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems. [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

HS-ESS3-5: 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 change and associated future impacts to Earth's systems. [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [*Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.*]

HS-ESS3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change). [Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and/or biosphere. An example of the far-reaching impacts from a human activity is how an increase in atmospheric carbon dioxide results in an increase in photosynthetic biomass on land and an increase in ocean acidification, with resulting impacts on sea organism health and marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

HS-LS4-6: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Science and Engineering Practices

Using Mathematics and Computational Thinking

- Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3)
- Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)
- Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS4-6)

Analyzing and Interpreting Data

- Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)

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). (HS-ESS3-2)

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. (HS-ESS3-1)
- 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. (HS-ESS3-4)
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)

Disciplinary Core Ideas

ESS3.A: Natural Resources

- Resource availability has guided the development of human society. (HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2)

ESS3.B: Natural Hazards

- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

ESS3.C: Human Impacts on Earth Systems

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)

- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

ESS3.D: Global Climate Change

- Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5)
- Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)

ETS1.B: Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

LS4.C: Adaptation

- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-6)

LS4.D: Biodiversity and Humans

- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (HS-LS4-6)

Crosscutting Concepts

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1)(HS-LS4-6)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6)

Stability and Change

- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-3),(HS-ESS3-5)
- Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)

Influence of Science, Engineering, and Technology on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-ESS3-1),(HS-ESS3-3)
- Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS-ESS3-2),(HS-ESS3-4)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. (HS-ESS3-3)
- New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-3)

Science Addresses Questions About the Natural and Material World

- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2)
- Science knowledge indicates what can happen in natural systems— not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2)
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2)

Science is a Human Endeavor

- Science is a result of human endeavors, imagination, and creativity. (HS-ESS3-3)

Scientific Investigations Use a Variety of Methods

- Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)

- New technologies advance scientific knowledge. (HS-ESS3-5)

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based on empirical evidence. (HS-ESS3-5)
- Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS3-5)

Rationale and Transfer Goals :

In this unit students *construct an explanation based on evidence* for how the availability of natural resources, occurrence of natural hazards are connected to human activity. Additionally, while students are exploring this idea they apply scientific and engineering ideas to *design, evaluate, and refine* a device that can be used to minimize the impacts of natural hazards. They create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity, and create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. They use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity, and evaluate or refine a technological solution that reduces impacts of human activities on natural systems. The crosscutting concepts of *cause and effect, stability and change, systems and system models* are called out as an organizing concept for these disciplinary core ideas.

Enduring Understandings:

- We need energy to live. Everything we use in modern society relies on energy as well. (cars, phones, appliances etc.)
- Most of the energy in the US is powered by non-renewable energy sources. These resources are finite, and many are controlled by other countries.
- Non-renewable resources also generate pollution, and keep us tied to the Middle East for resources.
- Energy costs us money. We pay the electric company or oil company every month for heat and electricity in our homes. We pay money for gas to run our cars.
- Conserving energy, and using less energy, will save us money, and will help the environment.
- Using renewable resources may cost more money initially (since it is a new technology)
- Renewable resources will not run out, and will become cheaper over time (like any new technology)
- Demanding more renewable resources and conserving non-renewable resources is a lifestyle choice. The market WILL respond if there is increased demand by consumers (people)

- Moving towards "greener" technology will have a great impact on businesses that rely on technology from non-renewable resources. There will be loss of jobs and economic impact on auto industries, and those who work in coal mines or the oil industry. It will lead to important questions that we, the members of society, need to address.
- Politics will come into play as people's livelihoods become jeopardized. This has happened in the past during times of change. (EX: Industrial Revolution) We need to decide what will be better for everyone and the environment that we live in, for the long term.

Essential Questions:
- How do human activities influence the global ecosystem?
- How might we change habits if we replaced the word “environment” with the word “life support system”?
- Is the damage done to the global life support system permanent?
- How can the impacts of human activities on natural systems be reduced?
- What are the relationships among earth’s systems and how are those relationships being modified due to human activity?

Content/Objectives		Instructional Actions	
Content ***What students will know***	**Skills** ***What students will be able to do***	**Activities/Strategies** ***How we teach content and skills***	**Evidence (Assessments)** ***How we know students have learned***
• Resource vitality has guided the development of human society. • Natural hazards and other geologic events have shaped the course of human history. • Empirical evidence is required to differentiate between cause and correlation and make	• ID non-renewable energy sources. • ID renewable energy sources. • Calculate the power that various appliances use, in kilowatt hours. • Calculate the energy cost of using various appliances, and calculate savings by switching to	• Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community. • Provide students with multiple choices for how they can represent their understandings (e.g.	• Construct an explanation based on valid and reliable evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. • Use empirical evidence to differentiate between

claims about how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activities. ● Modern civilization depends on major technological systems. ● Changes in climate can affect population or drive mass migration. ● Change and rates of change can be quantified and modeled over very short or very long periods. ● Some system changes are irreversible. ● Changes in the physical environment, whether naturally occurring or human induced, have contributed to the expansion of some species, the emergence of new distinct species as populations diverge	more energy efficient brands. ● ID problem areas in houses that might be resulting in higher electric bills for the owner. Give them tips for fixing those areas, along with the costs they would incur with the savings over time. ● Calculate fuel efficiencies for various models of cars. Compare costs and savings. ● Analyze and compare how incorporating green technologies can cause controversy. Debate and form an opinion on whose interests should be best served. (EX: in Cape Cod, the wind farm would generate savings over the long term for the entire area, but might be considered an eyesore to the people who have	multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). ● Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tools such as SKYPE, experts from the community helping with a project, journal articles, and biographies). ● Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). ● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and	how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. ● Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. ● Quantify and model change and rates of change in the relationships among management of natural resources, the sustainability of human populations, and biodiversity. ● Create or revise a simulation based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and

under different conditions, and the decline—and sometimes the extinction—of some species. ● Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. ● Thus sustaining biodiversity so that ecosystems' functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving	waterfront property worth millions of dollars). ● Look for cause-and-effect relationships between human population distribution and resource availability and distinguish between causality and correlation. ● Use evidence from data analysis to make inferences and predictions about the impacts of future climate change and global warming on displacement or migration of humans. ● Know that the sustainability of human societies and the biodiversity that supports them require responsible management of natural resources. ● Students collect data on growth patterns (exponential, logistic) and carrying capacity using, for example, bacterial	multiple ways to demonstrate their understanding. ● Use project-based science learning to connect science with observable phenomena. ● Structure the learning around explaining or solving a social or community-based issue. ● Provide ELL students with multiple literacy strategies. ● Collaborate with after-school programs or clubs to extend learning opportunities.	tradeoff considerations to test a solution to mitigate adverse impacts of human activity on biodiversity. ● Use empirical evidence to make claims about the impacts of human activity on biodiversity. ● Break down the criteria for the design of a simulation to test a solution for mitigating adverse impacts of human activity on biodiversity into simpler ones that can be approached systematically based on consideration of tradeoffs. ● Design a solution for a proposed problem related to threatened or endangered species or to genetic variation of organisms for multiple species.

landscapes of recreational or inspirational value. ● When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. ● Both physical models and computers can be used in various ways to aid the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test ways of solving a problem or to see which one is most efficient or economical, and in making a persuasive presentation to a client about how a given design will meet his or her needs. ● Criteria may need to be broken down into simpler	populations in a petri dish, status of local fish and mollusk populations in Narragansett Bay, erosion of eelgrass beds, or continued Quonset Point dredging. Data could also be collected on Asian Shore Crab infestation and competition with local crabs, or the negative effect of warming coastal estuary water temperature on flounder reproduction rates. ● Investigate and research major contributions of scientists and engineers who have developed technologies to produce less pollution and waste in order to prevent ecosystem degradation. ● Designing and evaluating a solution for a proposed problem related to threatened or endangered species.		● Analyze costs and benefits of a solution to mitigate adverse impacts of human activity on biodiversity. ● Evaluate or refine a technological solution that reduces impacts of human activities on natural systems based on scientific knowledge and student-generated sources of evidence; prioritize criteria and tradeoff considerations. ● Use a computational representation to illustrate the relationships among Earth systems and how these relationships are being modified due to human activity. ● Describe the boundaries of Earth systems. ● Analyze and describe the inputs and outputs of Earth systems. ● Benchmark Exam 1

ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. ● Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. ● Feedback (negative or positive) can stabilize or destabilize natural systems. ● Current models predict that, although future regional climate changes will be complex and will vary, average global temperatures will continue to rise. ● The outcomes predicted by global climate models strongly depend on the			

amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. ● Criteria may need to be broken down into similar ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. ● Human activities can modify the relationships among Earth systems.			

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
● Changes in the physical environment, whether naturally occurring or human induced, have contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different	● Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.	● Resources from the Holt Environmental Science Text: ○ Using the Figure: Power Plant Efficiency ○ Reading Skill Builder: Prediction Guide

conditions, and the decline—and sometimes the extinction—of some species. ● Thus sustaining biodiversity so that ecosystems' functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. ● Change and rates of change can be quantified and modeled over very short or very long periods. ● Know that the sustainability of human societies and the biodiversity that supports them require responsible management of natural resources. ● Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. ● Students collect data on growth patterns (exponential, logistic) and	● In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. ● 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. ● Adaptation by natural selection acting over generations is one important process by which 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,	○ Interpreting Statistics: Energy Consumption ○ Interpreting Statistics: Energy Production ○ Case Study: Methane Hydrates ○ MathPractice: World Energy Use ○ Using the Figure: Fossil Fuel Predictions ○ Student Opportunities: Design Contests ○ Using the Figure: Mesa Verde ○ Case Study: A Super-Efficient Home ○ Student Opportunities: Renewable Energy Opportunities ○ Use the Figure: Solar Cells and Light ○ Interpreting Statistics: The cost of Wind Power ○ Career: Renewable Energy

carrying capacity using, for example, bacterial populations in a petri dish, status of local fish and mollusk populations in Narragansett Bay, erosion of eelgrass beds, or continued Quonset Point dredging. Data could also be collected on Asian Shore Crab infestation and competition with local crabs, or the negative effect of warming coastal estuary water temperature on flounder reproduction rates. ● Use evidence from data analysis to make inferences and predictions about the impacts of future climate change and global warming on displacement or migration of humans. ● Change and rates of change can be quantified and modeled over very short or very long periods. ● Criteria may need to be broken down into similar ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. ● Human activities can modify the relationships among Earth systems.	the distribution of traits in a population changes. ● Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. ● The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. ● The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. ● Human activities have significantly altered the	

• Investigate and research major contributions of scientists and engineers who have developed technologies to produce less pollution and waste in order to prevent ecosystem degradation.	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. • 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. • 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	

	science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.	

Key resources:

Cost-Benefit Analysis Primer: Students read this explanation about how cost-benefit analysis is derived and applied in order to apply this model to design solutions related to human sustainability. Students then read the application of CBA to water sanitation.

Carbon Stabilization Wedge: Students play this game in order to evaluate competing design solutions for developing, managing, and utilizing energy resources based on cost-benefit ratios.

One For All: A Natural Resources Game: Identify a strategy that would produce a sustainable use of resources in a simulation game. Draw parallels between the chips used in the game and renewable resources upon which people depend. Draw parallels between the actions of participants in the game and the actions of people or governments in real-world situations.

Building Biodiversity and the PREDICTS project and GLOBIO project: Students explore this website to develop an understanding of how computational models of the impacts on biodiversity are created. Next, they explore Conservation Maps for a global perspective of land use and conservation efforts.

21st Century Life & Careers:

9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.

Career Readiness, Life Literacies, & Key Skills:

9.4.12.CT.3: Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).

9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately.

9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity.

9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.

Interdisciplinary Connections/Companion Standards:

NJSLS Mathematics

HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

NJSLS ELA

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-4), (HS-ESS3-5)

RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-ESS3-4)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS4-6)

Companion Standards for ELA in Science and Technical Subjects: Reading

RST.11-12.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.

RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Companion Standards for ELA in Science and Technical Subjects: Writing

WHST.11-12.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.