Wall Township Public Schools	Board Approval Date: 8/15/23

LLD SCIENCE Grades 9-12 Year 4

LLD Science is designed to give students an understanding of the various fields of science. The intent of this course is to provide each student opportunity to acquire knowledge of major scientific concepts presented throughout the high school career. From this conceptual base, students will be encouraged to foster critical thinking skills, to apply knowledge and to identify the real-life significance of Science

Course Sequence & Pacing

Unit Title	MP/Weeks
Unit 1: Conservation/Preservation	MP 1
Unit 2: Social Sciences	MP 2
Unit 3: Architecture & Landmarks	MP 3
Unit 4: Research	MP 4

New Jersey Student Learning Standards Science

Science

Scientific and technological advances have proliferated and now permeate most aspects of life in the 21st century. It is increasingly important that all members of our society develop an understanding of scientific and engineering concepts and processes. Learning how to construct scientific explanations and how to design evidence-based solutions provides students with tools to think critically about personal and societal issues and needs. Students can then contribute meaningfully to decision-making processes, such as discussions about climate change, new approaches to health care, and innovative solutions to local and global problems.

Three Dimensions of NJSLS Science

Disciplinary Core Ideas (DCI)

The fundamental ideas that are necessary for understanding a given science discipline. The core ideas all have broad importance within or across science or engineering disciplines, provide a key tool for understanding or investigating complex ideas and solving problems, relate to societal or personal concerns, and can be taught over multiple grade levels at progressive levels of depth and complexity.

Disciplinary Core Ideas in Physical Science (PS)
Disciplinary Core Ideas in Life Science (LS)
Disciplinary Core Ideas in Earth and Space Science (ESS)
Disciplinary Core Ideas in Engineering, Technology, and the Application of Science (ETS)

Science and Engineering Practices (SEP)

The practices are what students DO to make sense of phenomena. They are both a set of skills and a set of knowledge to be internalized. The SEPs reflect the major practices that scientists and engineers use to investigate the world and design and build systems.

Crosscutting Concepts (CCC)

These are concepts that hold true across the natural and engineered world. Students can use them to make connections across seemingly disparate disciplines or situations, connect new learning to prior experiences, and more deeply engage with material across the other dimensions. The NGSS requires that students explicitly use their understanding of the CCCs to make sense of phenomena or solve problems.

Science and Engineering Practices (SEP)	**Crosscutting Concepts (CCC)**
• Asking Questions and Defining Problems • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Developing and Using Models • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Using Mathematics and Computational Thinking • Obtaining, Evaluating, and Communicating Information	• Patterns • Cause and Effect: Mechanism and Explanation • Scale, Proportion, and Quantity • Systems and System Models • Energy and Matter • Structure and Function • Stability and Change

Unit 1

Stage 1: Desired Results

Unit 1: Conservation/Preservation

Unit Summary: In this unit of study, students engage in argument from evidence, develop and use models, ask questions and define problems, construct explanations and design solutions, and evaluate information. This unit focuses on ideas surrounding energy and energy transformations as related to the needs for human activity.

Unit 1 Learning Targets

Next Generation Science Standards:

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles

NJSLS Grade Level Standards:

Conventions of Standard English

NJSLSA.L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

NJSLSA.L2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

Knowledge of Language

NJSLSA.L3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

Vocabulary Acquisition and Use

NJSLSA. L4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.

NJSLSA.L5. Demonstrate understanding of word relationships and nuances in word meanings. NJSLSA.L6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

Curricular Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements

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.6: Identify transferable skills in career choices and design alternative career plans based on those skills

Computer Science & Design Thinking *(CS & DT)*:

8.1.2.CS.1: Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.

Interdisciplinary Connections:

IEP Goals & Objectives, ELA, Math, Social Studies

Unit Essential Questions:	**Unit Enduring Understandings:**
What is energy? What is the best energy source for a home? How would I meet the energy needs of a house of the future? How can we use mathematics in decision-making about energy resources?	Energy causes things to happen. Energy is defined as the ability to do work anddepends on the motion and interactions of matter and radiation within that system. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. Analysis of costs and benefits is a critical aspect of decisions about technology.
Content-Students will know: Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. Energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. Radiation is a phenomenon in which energy stored in fields moves across spaces.	**Skills-Students will be able to:** Develop and use models based on evidence to illustrate that energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. Use mathematical expressions to quantify how the stored energy in a system depends on its configuration (e.g., relative positions of charged

Energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risksas well as benefits. New technologies and social regulations can change the balance of these factors. Models can be used to simulate systems and interactions, including energy,matter, and information flows, within and between systems at different scales. Engineers continuously modify design solutions to increase benefits while decreasing costs and risks.	particles, compressions of a spring) and how kinetic energy depends on mass and speed. Use mathematical expressions and the concept of conservation of energy to predict and describe system behavior. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost benefit ratios, scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g., economic, societal, environmental, and ethical considerations). Use models to evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost–benefit ratios, scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors.

Stage 2: Evidence of Student Learning

Summative Assessments:

Claim, evidence & reasoning assessments

Formative Assessments:

Weekly assessments

Exit Tickets

Labs

Common Benchmark Assessments:

Cooperative and independent learning experiences

Class work and homework

Class discussion and participation

Alternative Assessments:

Multimedia presentations
Projects
Self Assessment Portfolio

Stage 3: Core Instructional Plan & Resources

Skill:	**Learning Activities:**
Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. The availability of energy limits what can occur in any system. Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximation inherent in models. Science assumes that the universe is a vast single system in which basic laws are consistent.	Teacher created materials - Google Slides and Docs Google Classroom Chromebooks Youtube Newsela EdPuzzle TPT Internet Resources CNN 10 Actively Learn Kahoot Gimkit Generation Genuis

Suggested Activities for Differentiation

Suggested Strategies and Practices that Support Students with Disabilities:

-Small group/One to one
- Additional time
- Review of directions
- Student restates information
-Space for movement or breaks
- Extra visual and verbal cues and prompts
- Preferential seating
- Follow a routine/schedule
- Rest breaks
- Verbal and visual cues regarding directions and staying on task
- Checklists
- Immediate feedback

Suggested Strategies and Practices that Support English Language Learners:

- Personal glossary
- Text-to-speech
- Extended time
- Simplified / verbal instructions
- Frequent breaks
-Flexible Grouping
-Goal-Setting with Students

Students At Risk of Failure:
-Alternative Assessments
-Games and Tournaments
-Learning Contracts
-Leveled Rubrics
-Personal Agendas
-Flexible Grouping
-Goal-Setting with Students

Students with 504 Plans:
Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.

Specific Strategies and Practices that Support Gifted & Talented Students:
-Use of high level academic vocabulary/texts
- Problem-based learning
- Preassess to condense curriculum
- Interest-based research
- Authentic problem-solving
- Homogeneous grouping opportunities
- Knowledge and Skill Standards in Gifted Education for All Teachers
- Pre-K-Grade 12 Gifted Programming Standards
-Gifted Programming Glossary of Terms

Unit 2

Stage 1: Desired Results

Unit 2: Social Sciences

Unit Summary: This unit will focus on investigating the levels of organization of ecology and humans impact on those levels.

Unit 2 Learning Targets

Next Generation Science Standards:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

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Interdisciplinary Connections:

IEP Goals & Objectives, ELA, Math, Social Studies

Unit Essential Questions:	**Unit Enduring Understandings:**
What is ecology? In what ways do organisms interact with each other? In what ways do nonliving (abiotic) factors affect organisms in an ecosystem? How do organisms affect their environment?	Investigate and analyze populations in an ecosystem. Investigate energy flow in ecosystems. Observe populations and determine the function organisms serve in an ecosystem. Investigate factors (abiotic and biotic) that affect the number of organisms an ecosystem can support.
Content-Students will know:	**Skills-Students will be able to:**
What is the primary theme of ecology? Why are models important to ecology? What are the five levels of organization at which ecology can be studied? What are populations and how do scientists study them? How are populations measured? What are the factors that have affected human population growth over time?	Organisms are dependent on both the living and nonliving factors within an environment. Ecosystems are dynamic and can change over time. Disruptions to these systems can lead to changes in populations. Growth of organisms and population increases are limited by access to resources. Patterns of interactions exist among organisms across multiple ecosystems, such as predatory, mutually-beneficial, and competitive. Biodiversity is the variety of species in ecosystems. Biodiversity of a system can be a good indicator of the health and quality of the system.

What is species interaction? What are the patterns in communities? What are the eight major biomes? What are the various aquatic ecosystems? How have humans affected the environment?	In addition to the availability of resources, predatory interactions may reduce the number of organisms that exist. Food webs are models that show the flow of matter and energy through a system of three groups: producers, consumers, and decomposers. Atoms that make up the organisms in an ecosystem are cycled between the living and nonliving parts of a system.

Stage 2: Evidence of Student Learning

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Formative Assessments:

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Alternative Assessments:

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Projects

Self Assessment Portfolio

Stage 3: Core Instructional Plan & Resources

Skill:	**Learning Activities:**
There is a strong cause and effect relationship between resources and the growth of organisms and groups of organisms. Patterns of interactions between organisms and abiotic components exist in all types of ecosystems, such as competitive, predatory, and mutually beneficial relationships. Matter and energy are conserved within the boundaries of a system. There are many patterns of interactions among organisms in ecosystems. Explain how matter and energy cycle and flow through an ecosystem.	Teacher created materials - Google Slides and Docs Google Classroom Chromebooks Youtube Newsela EdPuzzle TPT Internet Resources CNN 10 Actively Learn Kahoot Gimkit Generation Genuis

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Unit 3

Stage 1: Desired Results

Unit 3: Architecture & Landmarks

Unit Summary: In this unit students study land, water and air resources to illustrate how Earths' interacting systems and illustrate the relationships among management of natural resources (land, water air), the sustainability of human populations, and investigate ways to mitigate adverse impacts of human activity.

Unit 3 Learning Targets

Next Generation Science 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 have influenced human activity.

HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

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 systems.

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Interdisciplinary Connections:
IEP Goals & Objectives, ELA, Math, Social Studies

Unit Essential Questions:	**Unit Enduring Understandings:**
How do we monitor the health of the environment (our life support system of land, water and air)? How and why are Earth's natural resources of air, water and land limited? What impact do the resources of land, water and air have on our lives and the lives of all living things? What are the impacts of human activities on natural systems and how can they be reduced?	Humans depend upon Earth's land, water, atmosphere and biosphere for many resources. These resources are limited, distributed unevenly, and a result of Earth' geological processes. The land, water and air of our planet are part of complex Earth systems and cycles that have a direct impact of our daily lives and the lives of all living things on Earth. Human activity affects Earth's natural resources in a variety of ways and more than any other species. We need to use Earth's finite resources in a sustainable way.
Content-Students will know: Understand how critical our land, water and air are to all life on Earth. Investigate how we use our land and soil. The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. The properties include water's exceptional capacity to absorb, store, and release large amounts of energy; cohesion; expand upon freezing, dissolve and transport materials. Investigate the importance of our atmosphere Changes in the atmosphere occur due to human activity. The total amount of energy and matter in closed systems is conserved. Cycling of resources among and between the hydrosphere, atmosphere, geosphere, and biosphere is conserved.	**Skills-Students will be able to:** Conduct an investigation of the properties of land, water and air and its effects on Earth materials and surface processes. Develop a model based on evidence to describe the cycling of resources among the hydrosphere, atmosphere, geosphere, and biosphere. Develop a model based on evidence to illustrate the biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere, providing the foundation for living organisms.

Stage 2: Evidence of Student Learning

Summative Assessments:

Claim, evidence & reasoning assessments

Formative Assessments:

Weekly assessments

Exit Tickets

Labs

Common Benchmark Assessments:

Cooperative and independent learning experiences

Class work and homework

Class discussion and participation

Alternative Assessments:

Multimedia presentations

Projects

Self Assessment Portfolio

Stage 3: Core Instructional Plan & Resources

Skill:	**Learning Activities:**
Resource vitality has guided the development of human society. The sustainability of human societies and the biodiversity that supports them require responsible management of natural resources. Change and rates of change can be quantified and modeled over very short or very long periods. Some system changes are irreversible. Modern civilization depends on major technological systems. New technologies can have deep impacts on society and the environment.	Teacher created materials - Google Slides and Docs Google Classroom Chromebooks Youtube Newsela EdPuzzle TPT Internet Resources CNN 10 Actively Learn Kahoot

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- Interest-based research
- Authentic problem-solving
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-Gifted Programming Glossary of Terms

Unit 4

Stage 1: Desired Results

Unit 4: Research

Unit Summary: In this unit students will learn experimentation is one of the key parts of the scientific method. Under the scientific method, a scientist asks a question or forms a hypothesis. Then, based on research or prior knowledge of the issue at hand, the scientist designs an experiment to test that hypothesis. The scientist generally performs the experiment several times until the he/she has a significant amount of data. After analyzing the data derived from the experiment, the scientist draws a conclusion.

Unit 4 Learning Targets

Next Generation Science Standards:

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles

HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

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Curricular Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

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Computer Science & Design Thinking ***(****CS & DT****)*****:**

8.1.2.CS.1: Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.

Interdisciplinary Connections:

IEP Goals & Objectives, ELA, Math, Social Studies

Unit Essential Questions:	**Unit Enduring Understandings:**
How do you form a testable hypothesis that is logically connected to the problem and the design of the experiment? How do you design and conduct appropriate types of controlled scientific investigations, using the appropriate tools and techniques, to make observations and gather data to answer various questions?	Scientific inquiry is a thoughtful and coordinated attempt, through a continuous process of questioning, data collection, analysis and interpretation, to describe, explain, and predict natural phenomena. Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.

How do you assess the data, using mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms? Why is it essential to assess the validity of the experiment's design and the credibility of scientific claims in different sources of information? How do you communicate your findings, using relevant scientific vocabulary and clear logic, which are based on the results generated during the experiment?	Scientific literacy includes the ability to read, write, discuss, and present coherent ideas about science. Scientific literacy includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media. Scientific numeracy includes the ability to use universal mathematical operations and procedures to calculate, analyze and present scientific data and ideas.
Content-Students will know: How to employ the scientific method in drawing logical conclusion to a given inquiry. How to collect and analyze data using proper numerical scientific format for a given guided inquiry. How scientific findings can be communicated with others.	**Skills-Students will be able to:** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. Formulate a testable hypothesis. Design a controlled experiment where the independent and dependent variables are accurately identified. Utilize instrument methodology that is appropriate for the design of the experiment. Record data in the appropriate units of measure, and be able to convert between different units of measure.

Stage 2: Evidence of Student Learning

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Labs

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Alternative Assessments:
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Stage 3: Core Instructional Plan & Resources

Skill:
Plan and conduct an investigation to gather evidence to compare.
Use the periodic table as a model to predict the relative properties of elements based on the patterns.
Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

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