COURSE TITLE

Science 4

LENGTH

Full Year

DEPARTMENT

STEM Department

SCHOOL

Pierrepont Elementary School

DATE

July 15, 2019

Initial BOE Approval Date (Born on): 6/15/2015

Science 4

I. Introduction/Overview/Philosophy

The best way for students to appreciate the scientific enterprise, learn important scientific concepts, and develop the ability to think well is to actively construct ideas through their own inquiries, investigations, and analyses. Science is an active enterprise, made active by our human capacity to think. Scientific knowledge advances when scientists observe objects and events, think about how they relate to what is known, test their ideas in logical ways, and generate explanations that integrate the new information into the established order. Thus the scientific enterprise is both what we know (content) and how we come to know it (process).

The performance expectations in fourth grade help students formulate answers to questions such as: "What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth's features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?" (NGSS).

II. Objectives

Course Outline:

1. The Birth of Rocks
    a. Can a Volcano Pop Up in your Backyard
    b. Why do some volcanoes explode?
    c. Will a mountain last forever?
    d. How could you survive a landslide?
2. Energizing Everything
    a. How can a car run without gas?
    b. What makes roller coasters go fast?
    c. Why is the first hill of a roller coaster always the highest?
    d. Could you knock down a building using only dominoes?
    e. Can you build a chain reaction machine?
    f. What if there were no electricity?
3. Human Machine
    a. Why do your biceps bulge?
    b. What do blind people see?
    c. How can animals see in the dark?
    d. How does your brain control your body?
4. Waves of Sound
    a. How far can a whisper travel?
    b. What would happen if you screamed in outer space?
    c. Why are some places sounds high and some sounds low?

Student Outcomes:

After successfully completing this course, the student will:

- Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
- Generate and compare multiple solutions that use patterns to transfer information.
- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Analyze and interpret data from maps to describe patterns of Earth's features.
- Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

New Jersey Student Learning Standards

CAREER READY PRACTICES

CRP1 Act as a responsible and contributing citizen and employee.

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2 Apply appropriate academic and technical skills.

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation

CRP4 Communicate clearly and effectively and with reason.

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting

with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

TECHNOLOGY

Standard 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
Strand A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
8.1.5.A.1- Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
8.1.5.A.3- Use a graphic organizer to organize information about problem or issue.
Strand E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

8.1.8.E.1- Use digital tools to research and evaluate the accuracy of, relevance to and appropriateness of using print and non-print electronic information sources to complete a variety of tasks

Strand F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.1.5.F.1- Apply digital tools to collect, organize, and analyze data that support a scientific finding.

Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

8.2.5.B.4- Research technologies that have changed due to society's changing needs and wants.

8.2.5.B.6- Compare and discuss how technologies have influenced history in the past century.

Strand C. Design: The design process is a systematic approach to solving problems.

8.2.5.C.1- Collaborate with peers to illustrate components of a designed system.

8.2.5.C.4- Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Strand D. Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

8.2.5.D.3- Follow step by step directions to assemble a product or solve a problem.

21ST CENTURY LIFE AND CAREERS

9.2 Career Awareness, Exploration, and Preparation

Strand A: Career Awareness

9.2.4.A.1 Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals.

9.2.4.A.4 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.

NEW JERSEY STUDENT LEARNING STANDARDS- SCIENCE

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.
4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

III. Proficiency Levels

This is a full year course for Grade 4 students.

IV. Methods of Assessment

Student Assessment
Assessment will fall into two categories: formative and summative. Formative assessments include teacher observation, lab work, and performance assessment tasks. Summative assessments demonstrate the extent and depth of learning. End of the unit assessments and portfolios of accumulated work may serve as tools for this type of evaluation.

Curriculum/Teacher Assessment
The teacher will provide the subject area supervisor with suggestions for changes on an ongoing basis.

V. Grouping

This is a required Grade 4 full year course.

VI. Articulation/Scope & Sequence/Time Frame

Course length is one year.

VII. Resources

Texts/Supplemental Reading/References

Resources may include but are not limited to:

1. www.mysteryscience.com
2. Bill Nye Videos
3. https://newsela.com/
4. www.brainpop.com

5. Science World Magazine

VIII. Suggested Activities

Appropriate activities are listed in the curriculum map.

IX. Methodologies

The following methods of instruction are suggested: lecture, group projects, demonstration, hands-on applications, and class presentations.

X. Interdisciplinary Connections

At this grade level, connections to many other disciplines are appropriate and natural. Reading and writing become an integral part of the science process. Connections with mathematics are frequent throughout both curricula. Technology plays an important process in learning science as well.

XI. Differentiating Instruction for Students with Special Needs: Students with Disabilities, Students at Risk, English Language Learners, and Gifted & Talented Students

Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in multiple ways as they celebrate students' prior knowledge. By providing appropriately challenging learning, teachers can maximize success for all students.

Differentiating in this course includes but is not limited to:

Differentiation for Support (ELL, Special Education, Students at Risk)

- Peer mentoring on problems
- Differentiated teacher feedback on assignments
- Modeling out problems on whiteboard
- Visual aids as we project problems on whiteboard
- Study guides
- Tiered assignments
- Scaffolding of materials and assignments
- Re-teaching and review
- Guided note taking
- Exemplars of varied performance levels
- Multi-media approach to accommodating various learning styles

Differentiation for Enrichment

- Supplemental reading material for independent study
- Flexible grouping
- Tiered assignments
- Topic selection by interest
- Enhanced expectations for independent study

- Elevated questioning techniques using Webb's Depth of Knowledge matrix

XII. Professional Development

The teacher will continue to improve expertise through participation in a variety of professional development opportunities.

XII. Curriculum Map/Pacing Guide

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
The Birth of Rocks • Can a Volcano Pop Up in your Backyard? • Why do some volcanoes explode? • Will a mountain last forever? • How could you survive a landslide?	10 Weeks	*For Support:* • Rephrasing questions for better understanding and new concepts • Scaffolding using cooperative learning groups locating Volcanoes. *For Enhancement:* • Video documentary on Paricutin Volcano • Video and Questions on Salton Sea boiling mud-pots.	4-ESS1-1 4-ESS2-2 4-ESS2-1 4-ESS3-2 CRP1,2,4,6,7,8,11,12 8.1.5.A.1, 8.1.5.A.3, 8.1.5.E.1, 8.1.5.F.1 8.2.5.B.4, 8.2.5.B.6, 8.2.5.C.1, 8.2.5.C.4 9.2.4.A.1, 9.2.4.A.4	*Formative Assessment:* • Homework • Group work on Rock Weathering • Group Discussions *Summative Assessment* • End Topic Quiz • Unit Test on Rock Cycle and Earth Processes
Energizing Everything • How can a car run without gas? • What makes roller coasters go fast? • Why is the first hill of a roller coaster always the highest? • Could you knock down a building using only	10 Weeks	*For Support:* • Teacher Modeling for domino building • Allowing errors on section quizzes • Using graphic organizers to show rate of speed for roller coasters	4-PS3-1 4-PS3-4 4-PS3-3 3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3 4-PS3-2 CRP1,2,4,6,7,8,11,12 8.1.5.A.1, 8.1.5.A.3, 8.1.5.E.1, 8.1.5.F.1	*Formative Assessment:* • Exit Tickets • Classwork • Cooperative Work *Summative Assessment* • End of Unit Test on Motion • Roller Coaster Projects

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
dominoes? • Can you build a chain reaction machine? • What if there were no electricity?		*For Enhancement:* • Online videos on food as energy, creating a balloon rocket • Newsela reading on "What goes up must come down" • Video on roller coaster building	8.2.5.B.4, 8.2.5.B.6, 8.2.5.C.1, 8.2.5.C.4 9.2.4.A.1, 9.2.4.A.4	using marbles and foam track
Human Machine • Why do your biceps bulge? • What do blind people see? • How can animals see in the dark? • How does your brain control your body?	13 Weeks	*For Support:* • Pre-teaching of new vocabulary terms for each section • Note cards with multiple steps for each group project • Modified assessments for each unit *For Enhancement:* • Extending unit project to create a robot hand • Online simulator of the working eye	4-LS1-1 4-LS1-2 4-PS4-2 CRP1,2,4,6,7,8,11,12 8.1.5.A.1, 8.1.5.A.3, 8.1.5.E.1, 8.1.5.F.1 8.2.5.B.4, 8.2.5.B.6, 8.2.5.C.1, 8.2.5.C.4 9.2.4.A.1, 9.2.4.A.4	*Formative Assessment:* • Homework • Science IXL • Group Classwork • Topic Projects *Summative Assessment* • End of unit tests on the human body and how it functions • Benchmark assessment for each unit
Waves of Sound • How far can a whisper travel? • What would happen if you screamed in outer space? • Why are some places	6 Weeks	*For Support:* • Rephrasing questions for better understanding and new concepts • Modified assessments for each unit	4-PS4-1 4-PS4-3 CRP1,2,4,6,7,8,11,12 8.1.5.A.1, 8.1.5.A.3, 8.1.5.E.1, 8.1.5.F.1 8.2.5.B.4, 8.2.5.B.6, 8.2.5.C.1, 8.2.5.C.4	*Formative Assessment:* • Homework • Exit tickets on space and volume • Group Project on Whispers

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
sounds high and some sounds low?		*For Enhancement:* • *Online Challenge: "How can you be quiet"* • Video on how to make a road tune	9.2.4.A.1, 9.2.4.A.4	*Summative Assessment* • Projects on volume in a small room • Quiz on ending unit