BOE Approved 8/18

Cliffside Park Public Schools

Science

Unit Name: Motion and Matter (Physical Science)

Resource: FOSS Next Generation, Delta Education

Duration: Ten Weeks

Enduring Understandings

Forces

- Magnetic force between objects does not require that the objects be in contact; the strength of the magnetic force depends on the objects' properties and their distance apart.
- How magnets interact depends on their orientation
- Each force acting on an object has a strength and a direction.
- Gravity is the force that pulls things toward the center of Earth.

Patterns of Motion

- The patterns of an object's motion in various situations can be observed and measured.
- When past motion exhibits a regular pattern, future motion can be predicted from it.
- A wheel-and-axle system with two sizes of wheels describes a curved path when rolled down a slope.
- A twirly bird is a simple winged system that spins when it interacts with air; variables affect twirler performance.
- Tops exhibit rotational motion when torque is applied to the axial shaft; variables affect top performance.

Engineering

- Possible solutions to a problem are limited by available materials and other resources.
- The success of a designed solution is determined by considering the desired features of a solution.

- Research on a problem should be carried out before beginning to design a solution.
- The pattern of an object's or a system's motion in various situations can be observed and measured.
- When past motion exhibits a pattern, it can be used to predict future motion.

Mixtures

- A mixture is two or more materials distributed evenly throughout one another.
- A special class of mixture, a solution, results when a solid material dissolves (disappears) in a liquid.
- Starting materials change into new materials during chemical reactions.
- Mass is neither created nor destroyed during physical and chemical interactions. Matter is conserved.

Essential Questions

Forces

- What happens when magnets interact with other magnets and with paper clips?
- How is the magnetic field affected when more magnets are added?
- What causes change of motion?

Patterns of Motion

- How can we change the motion of wheels rolling down ramps?
- What rules help predict where a rolling cup will end up?Student-created question, e.g., What happens to the motion of a twirly bird when the wing length changes?
- What is the best design for a top?

Engineering

- What are some important features of a cart that will roll from here to there?
- How can you improve the design of your cart? Student-created questions, e.g., How does start position affect how far a cart rolls?
- How can you use magnets to do cart tricks?

Mixtures

- What happens when you mix two materials?
- What is the importance of accurate measurements for a metric field day?

<table>
<tr><th colspan="3">Focus of Standards</th></tr>
<tr><td>Student Outcomes

Forces

● I can ask questions while observing the interaction of magnets.
● I can develop a model to explain the attraction between magnets and paper clips.
● I can analyze and interpret data in order to make a prediction about the boundary of the magnetic field.

Patterns of Motion

● I can ask questions about how changes of system variables affect the system's motion.
● I can make observations to produce data to test a design.
● I can communicate observations and comparisons of motion, using precise vocabulary.

Engineering

● I can communicate with peers about proposed design solutions.
● I can compare proposals for design solutions on the basis of how well each one meets the criteria for success and how well each takes the constraints into account.

Mixtures

● I can make a number of simple mixtures.
● I can mix materials to observe solutions and reactions.
● I can weigh materials to confirm conservation of matter.</td><td>Skills

● Asking Questions and Defining Problems
● Developing and Using Models
● Classifying Information
● Observing Investigations
● Exploring New Ideas
● Planning and Carrying Out Investigations
● Analyzing and Interpreting Data
● Using Mathematics and Computational Thinking
● Constructing Explanations and Designing Solutions
● Engaging in Argument from Evidence
● Obtaining, Evaluating and Communicating Information</td><td>Assessments & Modifications

Assessments:
● Formative: Notebook Entries:
○ Notebook Entries
○ Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object
○ Ask questions to determine cause-and-effect relationships in electric or magnetic interactions between two objects not in contact with each other
○ Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion
○ Teacher Observation
○ Anecdotal Records/Notes
○ Make predictions using patterns of change.
○ Science notebook-engineering
○ Embedded Assessment Notes
● Summative Performance
○ Foss Post-test on Motion and Matter
○ Vocabulary check
● Benchmark Assessments:
○ Investigation Checks
○ Constructing models- Forces magnets and compasses</td></tr>
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• I can apply measurement concepts learned throughout the module to create field events that require measurement.		○ Constructing models-using available materials and design ○ Diagramming- an engineering solution for proposed problems ○ Applying- solutions for everyday problems- inventors • **Alternative:** ○ Conferences ○ Diagrams ○ Word Bank for vocabulary ○ Modeling ○ Illustrations of Forces on objects ○ Storybook assembly- cause and effect- patterns- rube goldberg devices

NJ Student Learning Standards: Science
3-PS2 Motion and Stability: Forces and Interactions
3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.*
3-5 ETS1 Engineering Design
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.

ELA: RI.3.1, RI.3.3, RI.3.4, RI.3.5, RI.3.7, RI.3.9
Math: 3.OA.1, 3.OA.2, 3.OA.3

NJ SLS: 21st Century Life and Careers

Career Ready Practices
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

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.
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.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.
D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
8.1.5.D.2 Analyze the resource citations in online materials for proper use.
8.1.5.D.4 Understand digital citizenship and demonstrate an understanding of the personal consequences of inappropriate use of technology and social media.
E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
8.1.5.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.
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.

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.
A. The Nature of Technology: Creativity and Innovation
Technology systems impact every aspect of the world in which we live.
8.2.5.A.2 Investigate and present factors that influence the development and function of a product and a system.
8.2.5.A.5 Identify how improvement in the understanding of materials science impacts technologies.
B. Technology and Society: Knowledge and understanding of human, cultural and societal values are fundamental when designing technology systems and products in the global society.
8.2.5.B.3 Investigate ways that various technologies are being developed and used to reduce improper use of resources.
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.
8.2.5.C.7 Work with peers to redesign an existing product for a different purpose.
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.1 Identify and collect information about a problem that can be solved by technology, generate ideas to solve the problem, and identify constraints and trade-offs to be considered.
8.2.5.D.3 Follow step by step directions to assemble a product or solve a problem.
8.2.5.D.7 Explain the impact that resources such as energy and materials used in a process to produce products or system have on the environment.

NJSLS: Science and Engineering Practices
NJSLS-S: 3-5
Practice 1. Asking questions (for science) and defining problems (for engineering) Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
Ask questions based on observations to find more information about the natural and/or designed world(s).
Ask and/or identify questions that can be answered by an investigation.
Practice 2. Developing and using models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
Distinguish between a model and the actual object, process, and/or events the model represents.
Compare models to identify common features and differences.
Practice 3. Planning and carrying out investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
With guidance, plan and conduct an investigation in collaboration with peers (for K).
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.
Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.
Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.
Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal.
Make predictions based on prior experiences.
Practice 4. Analyzing and interpreting data: Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
Record information (observations, thoughts, and ideas).
Use and share pictures, drawings, and/or writings of observations.
Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.

Compare predictions (based on prior experiences) to what occurred (observable events).
Analyze data from tests of an object or tool to determine if it works as intended.
Practice 6. Constructing explanations (for science) and designing solutions (for engineering) Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
Practice 7. Engaging in argument from evidence
Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).
Identify arguments that are supported by evidence.
Distinguish between opinions and evidence in one's own explanations.
Construct an argument with evidence to support a claim.

Core Instructional Materials:

- FOSS Next Generation: Motion and Matter(2016)

Supplemental Materials: (videos, leveled readers, Readworks, recommended books etc.)
Videos: https://www.fossweb.com/moduledetail?dDocName=G3842595&classId=
Recommended books: https://www.fossweb.com/additional-resources-books-xslt?dDocName=G4292315#non-fiction-books

21st Century Themes

- **Global Awareness:** students come to understand that humans use natural resources for everything they do and that people affect the world around them.
- **Environmental Literacy:** students will explore the origins of materials and resources that we use everyday (paper, fabric, wood.) Students will learn that these resources are finite and explore strategies for conserving natural resources (recycling.)

21st Century Skills
Creativity and Innovation

- Critical Thinking and Problem Solving
- Communication and Collaboration
- Students engage in science and engineering practices by asking questions, participating in collaborative investigations, observing, recording and interpreting data to build explanations.

Interdisciplinary Connections
NJSLS for ELA are introduced, developed, and practiced in the context of learning science content and engaging in the science and engineering practices.

ELA

- Read and comprehend science texts related to their prior experience and knowledge
- Write informational/explanatory texts, arguments to support claims, and narratives about experience in science
- Engage in collaborative discussions about science
- Learn new vocabulary and language structures in context

Math

- Participate in active investigations and apply mathematics during data gathering and analysis
- Interdisciplinary Extensions at the end of each investigation usually include a math problem of the week
- Analyze hypothetical data related to the context of the investigation

Mathematical Practices
The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics
- Use appropriate tools strategically.
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Differentiation/Accommodations/Modifications ***(Alternate Modes of Instruction and Support)***		
Modifications to Support Gifted and Talented Students	**Modifications to Support English Language Learners**	**Modifications to Support Our Learners (Students with IEPs/504s and At-Risk Learners)**
Newsela article:? Forces and motion: how they relate. Lexile: 800L Recommended non fiction books	Newsela article: Forces and motion: how they relate. Lexile: 590L (Spanish version) Equipment photo cards (spanish and english)	Newsela article: Forces and motion: how they relate. Lexile: 590L Storyboard- Forces in space

https://www.fossweb.com/additional-resources-books-xslt?dDocName=G4292315#non-fiction-books Independent research- Fundamental forces VR- atomic structure Debate / Compare and contrast-strong and weak forces Provide appropriate challenge for wide ranging skills and development areas. Participate in inquiry and project-based learning units of study Assigning roles within partnerships Differentiated supports: content, process, product, environment	Modeling atomic structure- in native language (illustrated) Push Pull-Changing Direction Marble Roll Invent a Back Scratcher from Everyday Materials Visual cues- image gallery https://www.fossweb.com/additional-resources-image-galleries-xslt?dDocName=G4292315#image-galleries Vocabulary log- Pronunciation/translation assistance https://dictionary.cambridge.org/us/ Vocabulary builder Thesaurus- https://www.thesaurus.com/ Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) Pair visual prompts with verbal presentations Front Load and immerse students in literacy and language experiences related to content Provide students with visual models, sentence stems, concrete objects, and hands-on materials. Model procedures for life skills. Collaboration between ELL and general education teacher to maximize learning	Equipment photo cards Investigating the Magnetic Force Field: Calculating the Magnetic Pull of a Magnet by Varying Distances Push Pull-Changing Direction Marble Roll Invent a Back Scratcher from Everyday Materials Lab simulation- Force https://phet.colorado.edu/en/simulation/forces-and-motion Matter song video Matter song a music video by untamed Science Playing with magnets- what are the two poles? Visual cues- image gallery https://www.fossweb.com/additional-resources-image-galleries-xslt?dDocName=G4292315#image-galleries Word walls Review student individual educational plan and/or 504 plan. Establish procedures for accommodations and modifications for assessments as per IEP/504. Establish procedures for modification of classwork and homework as per IEP/504. Modify classroom environment to support academic and physical needs of the students as per IEP/504. Provide appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team.

		Differentiation through content, process, product, environment Provide Title I services to students not meeting academic standards in ELA and/or Math. Provide instructional adaptations and interventions in the general education classroom. Modify classroom environment to support student needs. Differentiated instruction Basic Skills Intensive individual intervention

Sources

NJSLS Science Standards (2017): http://www.nj.gov/education/cccs/2016/science/
NJ: 2014 SLS: Technology: http://www.state.nj.us/education/cccs/2014/tech/8.pdf
NJSLS-S: Science and Engineering Practices: http://www.nj.gov/education/cccs/2016/science/3-5-ETS1.pdf
21st Century Life and Careers: http://www.state.nj.us/education/cccs/2014/career/9.pdf
Career Ready Practices: http://www.state.nj.us/education/cccs/2014/career/9.pdf
2015 FOSS Next Generation: www.FOSSweb.com
NSTA: https://ngss.nsta.org/
https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&resourceid=662