Science Curriculum

Grade 4

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6/1/2015
The Middletown Public Schools Curriculum for grades K-12 was completed June 2015 by a team of K-12 teachers. The team, identified as the Science Curriculum Writers referenced extensive resources to design the document that included but are not limited to:

- Next Generation Science Standards (NGSS)
- Next Generation Science Standards (NGSS) Appendices A-M
- A Framework for K-12 Science Education
- Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science and Technical Subjects (CCSS)
- Common Core State Standards for Mathematics (CCSS)
- University of Texas, Dana Center (science units of study)
- Best Practice, New Standards for Teaching and Learning in America’s Schools
- Classroom Instruction That Works
- Differentiated Instructional Strategies
- Model curriculum documents from several states
- Educational websites
- Webb’s Depth of Knowledge

The K-12 Curriculum identifies what all students should know and be able to do in science education. Each grade or course draws from The Next Generation Science Standards, Common Core English Language Arts and Mathematics Standards, research-based instructional strategies, resources, map (or suggested timeline), rubrics, and checklists.

The curriculum provides learners with a sequential comprehensive education in Science through the study of Next Generation Standards that includes:

- **Disciplinary Core Ideas:**
  - Physical Science
  - Life Science
  - Earth and Space Science
  - Engineering and Technology

- **Science and Engineering Practices:**
  - Asking questions and defining problems.
  - Developing and using models.
  - 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.

- **Crosscutting Concepts**
  - Patterns
  - Cause and Effect: Mechanism and Explanation
  - Scale, Proportion, and Quantity
  - Systems and System Models
  - Energy and Matter: Flows, Cycles, and Conservation
  - Structure and Function
  - Stability and Change

**Common Core State Standards** for English Language Arts that includes:

- **College and Career Readiness Anchor Standards for Reading**
  - Key Ideas and Details
  - Craft and Structure
  - Integration of Knowledge
  - Range of Reading

- **College and Career Readiness Anchor Standards for Writing**
  - Text Types and Purposes
  - Production and Distribution of Writing
  - Research to Build and Present Knowledge
  - Range of Writing

**Common Core State Standards** for Mathematics that includes:

- Mathematical content (e.g. expressions and equations, the number system, algebra, geometry)
- Mathematical practices
The curriculum provides a list of research-based best practice instructional strategies that the teacher may model and/or facilitate, e.g.

- Employs strategies of “best practice” (student-centered, experiential, holistic, authentic, expressive, reflective, social, collaborative, democratic, cognitive, developmental, constructivist/heuristic, and challenging).
- Differentiates instruction by varying the content, process, and product and implementing
  - Anchoring
  - Cubing
  - Jig-sawing
  - Pre/post assessments
  - Think/pair/share
  - Tiered assignments
- Analyzes formative assessment to direct instruction.
- Provides exemplars and rubrics.
- Provides opportunities for independent, partner and collaborative group work.
- Addresses multiple intelligences and brain dominance (spatial, bodily kinesthetic, musical, linguistic, intrapersonal, interpersonal, mathematical/logical, and naturalist).
- Models the use of graphic organizers: sequence organizers (chains, cycle), concept development (mind map), compare/contrast organizers (Venn diagrams, comparison charts), organizers (word web, concept map), evaluation organizers (charts, scales), categorize/classify organizers (categories, tree) relational organizers (fish bone, pie chart).
- Provides science practices opportunities such as:
  - Facilitating the science and engineering practices: Appendix F
    1. Asking questions (for science) and defining problems (for engineering)
    2. Developing and using models
    3. Planning and carrying out investigations
    4. Analyzing and interpreting data
    5. Using mathematics and computational thinking
    6. Constructing explanations (for science) and designing solutions (for engineering)
    7. Engaging in argument from evidence
    8. Obtaining, evaluating, and communicating information
  - Modeling Cross-cutting concepts: Appendix G
    1. Patterns.
    2. Cause and effect
    3. Scale, proportion, and quantity.
    4. Systems and system models.
    5. Energy and matter:
    7. Stability and change.
  - Implementing “equitable learning opportunities”
    1. Value and respect the experiences that all students bring from their backgrounds
    2. Articulate students’ background knowledge with disciplinary knowledge of science
    3. Offer sufficient school resources to support student learning
COMMON and SUGGESTED ASSESSMENTS

REQUIRED COMMON ASSESSMENTS
- Common Formative Assessments
- Common Summative Assessments

SUGGESTED ASSESSMENTS
- Anecdotal records
- Conferencing
- Collaboration
- Compiling/interpreting data
- Exhibits
- Interviews
- Investigations
- Graphs
- Graphic organizers
- Journals
- Labs
- Models
- Multiple Intelligences assessments, e.g.
  - Graphic organizing - visual
  - Collaboration - interpersonal
  - Role playing - bodily kinesthetic
- Oral presentations
- Predictions
- Rubrics/checklists
- Tests and quizzes
- Technology
- Think-alouds
- Writing genres
  - Opinion
  - Informative
- Vocabulary
RESOURCES FOR GRADE 4

Textbook
- Exploring Science National Geographic (2015)

National Geographic Science Kits:
- National Geographic, Life, Physical and Space Science

Supplementary Books, Teacher (T) Student (S)
- "National Geographic For Kids Magazine"
- The Next Generation Science Standards
- A Framework for K-12 Science Education Practices, Cross Cutting Concepts, and Core Ideas

Technology
- Computers
- LCD projectors
- Interactive boards

Websites
- http://smithsonianeducation.org/educators
- http://www.timeforkids.com/TFK/
- NGSS http://www.nextgenscience.org/ Next Generation Science Standards
- www.beaconlearningcenter.com (lessons)
- www.brainpop.com (license needed)
- www.educationworld.com/ (Laws of Motion)
- www.eia.doc.gov/kids
- www.funderstanding.com/coaster (force and motion)
- www.makeme genius.com/science-videos
- www.nbclearn.com/olympics (force and motions) videos
- www.sciencespot.net
- www.unitedstreaming.com

Generic Websites
- NGSS http://www.nextgenscience.org/ Next Generation Science Standards
- RIDE & NGSS https://www.ride.ri.gov/InstructionAssessment/Science/NextGenerationScienceStandards.aspx
  Explains each standard and demonstrates what it looks like at each grade
- www.utdanacenter.org Log-in: Rhode; Password: Island (RI Science units)
- https://www.pltw.org/our-programs/pltw-launch K-5 PLTW STEM Presentation (Project Lead the Way)
- http://www.nextgenscience.org/ngss-high-school-evidence-statements NGSS Evidence Tables (HS only)
## 4-PS3 Energy

**Performance Expectations**

Students who demonstrate understanding can:

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

[Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.]

**Essential knowledge and skills**

- Explain that energy can move in different ways.
- Explain that the speed of an object depends on the time it takes the object to move a certain distance.
- Explain that slower moving objects have less energy than faster moving objects.

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Cross Cutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constructing Explanations and Designing Solutions</strong></td>
<td><strong>PS3.A: Definitions of Energy</strong></td>
<td><strong>Energy and Matter</strong></td>
</tr>
<tr>
<td>Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</td>
<td>• The faster a given object is moving, the more energy it possesses.</td>
<td>• Energy can be transferred in various ways and between objects.</td>
</tr>
</tbody>
</table>

**Connections to**

- Connections to other DCIs in fourth grade: N/A
- Articulation of DCIs across grade-bands: MS.PS3.A

**Common Core State Standards Connections:**

- RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
- RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1)
- W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)
- W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1)
Specific Websites/Resources
- www.eia.doc.gov/kids
- www.unitedstreaming.com

Academic Vocabulary
- construct
- energy of an object
- evidence
- force
- gravity
- motion
- speed of an object

Performance Expectations

Students who demonstrate understanding can:

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

[Assessment Boundary: Assessment does not include quantitative measurements of energy.]

Essential knowledge and skills
- Understand that energy is conserved in the universe.
- Observe and describe basic forms of energy, including sound, light, heat, and electrical.
- Describe motion as the result of energy being used.
- Define energy as the source of motion or change.
- Identify and describe heat as the flow of energy from a warmer object to a cooler object.
- Describe that heat flows between objects until they are both the same temperature.
- Describe heat as energy produce when substances burn or certain kinds of materials rub against each other.
- Identify and describe light as a form of energy.
- Explain that energy can change from one form to another.
- Understand that energy exists in various forms, including sound.
- Recognize that vibrating objects make sound, and sound can make things vibrate.
- Understand that electric circuits may produce or use light, heat, sound, motion, and magnetic energy.
- Explain how electrical energy is transferred and changed through the use of a simple circuit.
### PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.
- Light also transfers energy from place to place.
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

### Connections to

Connections to other DCIs in fourth grade: N/A


Common Core State Standards Connections:

- W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

**Specific Websites/Resources**

- [www.eia.doc.gov/kids](http://www.eia.doc.gov/kids)
- [www.unitedstreaming.com](http://www.unitedstreaming.com)

**Academic Vocabulary**

- mass
- motion
- forces
- evidence
- transferred
- vibrations
- reflected
- circuit
- source
- conduct
- substances
- observations
- energy
- sound currents
- light currents
- heat currents
- electric currents
## Performance Expectations

Students who demonstrate understanding can:

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

- **[Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.]**
- **[Assessment Boundary: Assessment does not include quantitative measurements of energy.]**

### Essential knowledge and skills

- Understand that the faster an object moves, the more energy it possesses.
- Explore ways in which energy can be transferred.
- Investigate the relationship between speed and energy.
- Observe objects colliding and be able to ask questions that lead to further investigation. For example, if students roll a ball towards a wall, or roll two balls so that they collide, they may observe any or all of the following:
  - Change(s) in the direction of motion
  - Change(s) in speed
  - Change(s) in the type of energy (e.g., motion energy to sound energy, sound energy to heat energy)
  - Change(s) in the type of motion (rolling to bouncing).
- Recognize their investigations will help them understand that:
  - Energy can be transferred in various ways and between objects.
  - Energy is present whenever there are moving objects, sound, light, or electric currents.
  - Energy can be transferred from place to place by moving objects or through sound, light, or electric currents.
  - When objects collide, some energy may be changed or transferred into other types of energy.
- Recognize that motion can be changed in response to magnetic fields; a push or pull can cause objects to be in motion.
- Recognize that friction is a force that slows motion when objects are touching.

### Science and Engineering Practices

#### Asking Questions and Defining Problems
- Asking questions and defining problems in grades 3-5 builds on K–2 experiences and progresses to specifying qualitative relationships.
- Ask questions that can be investigated and predict reasonable

### Disciplinary Core Ideas

- **PS3.A: Definitions of Energy**
  - Energy can be transferred or transformed from one form to another.
  - Energy can be moved from place to place by moving objects or through sound, light, or electric currents.
- **PS3.B: Conservation of Energy and Energy Transfer**
  - Energy is present whenever there are moving objects, sound, light, or electric currents.

### Cross Cutting Concepts

- **Energy and Matter**
  - Energy can be transferred in various ways and between objects.
<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>Middletown Public Schools and The Next Generation Science Standards</th>
<th>INSTRUCTIONAL STRATEGIES</th>
<th>RESOURCES</th>
<th>ASSESSMENTS</th>
</tr>
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<tbody>
<tr>
<td><strong>PS3.C: Relationship Between Energy and Forces</strong></td>
<td>outcomes based on patterns such as cause and effect relationships.</td>
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<td>heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.</td>
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<td>PS3.C: Relationship Between Energy and Forces</td>
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<tr>
<td></td>
<td>• When objects collide, the contact forces transfer energy so as to change the objects’ motions.</td>
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<td><strong>Connections to</strong></td>
<td>Connections to other DCIs in fourth grade: N/A</td>
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<tr>
<td><strong>Academic Vocabulary</strong></td>
<td>• predict</td>
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**Performance Expectations**

Students who demonstrate understanding can:

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

[Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.]
### Science and Engineering Practices

**Constructing Explanations and Designing Solutions**

- Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
  - Apply scientific ideas to solve design problems.

### Disciplinary Core Ideas

- **PS3.B: Conservation of Energy and Energy Transfer**
  - Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.

- **PS3.D: Energy in Chemical Processes and Everyday Life**
  - The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use.

- **ETS1.A: Defining Engineering Problems**
  - Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

### Cross Cutting Concepts

- **Energy and Matter**
  - Energy can be transferred in various ways and between objects.

- **Connections to Engineering, Technology, and Applications of Science**
  - Engineers improve existing technologies or develop new ones.

- **Connections to Nature of Science**
  - Science is a Human Endeavor
    - Most scientists and engineers work in teams.
    - Science affects everyday life.
### Connections to

Connections to other DCIs in fourth grade: N/A


### Common Core State Standards Connections:

- W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- **Mathematics** -
  - 4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

### Specific Websites/Resources

- [www.eia.doc.gov/kids](http://www.eia.doc.gov/kids)
- [www.unitedstreaming.com](http://www.unitedstreaming.com)

### Academic Vocabulary

- **convert**
- **define**
- **design**
- **device**
- **energy**
- **energy transfer**
- **motion**
- **refine**
- **scientific ideas**
- **stored energy**
- **test**

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### PHYSICAL SCIENCE

#### 4-PS4 Waves and their Applications in Technologies for Information Transfer

**Performance Expectations**

Students who demonstrate understanding can:

- **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.**
  
  [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.]

  [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]

  **Essential knowledge and skills**

  - Develop and use a model of waves to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move.
  - Explain that waves, which are regular patterns of motion, can be made in water by disturbing the surface.
- Explain that when waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach.

### Science and Engineering Practices

**Developing and Using Models**
- Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.

**Connections to Nature of Science**
- Scientific Knowledge is Based on Empirical Evidence
  - Science findings are based on recognizing patterns.

### Disciplinary Core Ideas

**PS4.A: Wave Properties**
- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave except when the water meets the beach. (Note: This grade band endpoint was moved from K–2.)
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

### Cross Cutting Concepts

**Patterns**
- Similarities and differences in patterns can be used to sort and classify natural phenomena.

### Connections to

Connections to other DCIs in fourth grade: 4.PS3; 4.PS3.B
Articulation of DCIs across grade-bands:; MS.PS4.A

### Common Core State Standards Connections:

**ELA/Literacy** – SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

**Mathematics** – MP.4 Model with mathematics
- 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures

### Specific Websites/Resources

- [www.eia.doc.gov/kids](http://www.eia.doc.gov/kids)
- [www.unitedstreaming.com](http://www.unitedstreaming.com)

### Academic Vocabulary

- amplitude
- wave length
- patterns
- model
- similarities
- differences
- waves
- surface
### 4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

[Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]

**Essential knowledge and skills**
- Develop a model that gives a conceptual understanding of the role that light plays in allowing us to see objects.
- Differentiate between reflect and refract.
- Determine what kinds of objects light can pass through.

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
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<th>Cross Cutting Concepts</th>
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<tbody>
<tr>
<td>Developing and Using Models</td>
<td>PS4.B: Electromagnetic Radiation</td>
<td></td>
</tr>
<tr>
<td>Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</td>
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<tr>
<td>• Develop a model to describe phenomena.</td>
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**Connections to**

**Common Core State Standards Connections:**
- ELA/Literacy – SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.
- Mathematics – MP.4 Model with mathematics
- 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures

**Specific Websites/Resources**
- [www.eia.doc.gov/kids](http://www.eia.doc.gov/kids)
- [www.unitedstreaming.com](http://www.unitedstreaming.com)

**Academic Vocabulary**
- model
- opaque
- phenomena
- reflect
- refract (bend)
- translucent
- transparent
4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*

[Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1’s and 0’s representing black and white to send information about a picture, and using Morse code to send text.]

**Essential knowledge and skills**

- Sort and classify natural phenomena using similarities and differences in patterns.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.
- Develop a model (e.g., diagram, analogy, or physical model) of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move. (Assessment does not include interference effects, electromagnetic waves, nonperiodic waves, or quantitative models of amplitude and wavelength).
- Understand relevant scientific concepts and research findings is important in engineering.
- Recognize that engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.
- 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.

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<td><strong>PS4.C: Information Technologies and Instrumentation</strong></td>
<td><strong>Patterns</strong></td>
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<tr>
<td>Constructing explanations and designing solutions in 3-5 builds on K-2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</td>
<td>- Digitized information transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.</td>
<td>- Similarities and differences in patterns can be used to sort and classify natural phenomena.</td>
</tr>
<tr>
<td>- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.</td>
<td><strong>ETS1.C: Optimizing The Design Solution</strong></td>
<td><strong>Connections to Engineering, Technology, and Applications of Science</strong></td>
</tr>
<tr>
<td><strong>Connections to other DCIs in fourth grade:</strong> 4.ESTS1.A</td>
<td>- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (secondary to 4-PS4-3)</td>
<td><strong>Interdependence of Science, Engineering, and Technology</strong></td>
</tr>
<tr>
<td><strong>Articulation of DCIs across grade-bands:</strong> K.ETS1.A; 2.ESTS1.B; 2.ESTS1.C; 3.PS2.A; MS.PS4.C; MS.ESTS1.B</td>
<td><strong>Common Core State Standards Connections:</strong></td>
<td><strong>Knowledge of relevant scientific concepts and research findings is important in engineering.</strong></td>
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<tr>
<td><strong>ELA/Literacy</strong> - R1.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text</td>
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<tr>
<td>R1.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.</td>
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</table>
### SCIENCE CURRICULUM Grade 4

Curriculum Writers: Caitlin Coyne and Margaret Pereira

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>Middletown Public Schools and The Next Generation Science Standards</th>
<th>INSTRUCTIONAL STRATEGIES</th>
<th>RESOURCES</th>
<th>ASSESSMENTS</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>Life Science</td>
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<tr>
<td>4-LS1 From Molecules to Organisms: Structures and Processes</td>
<td><strong>Performance Expectations</strong></td>
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<tr>
<td>Students who demonstrate understanding can:</td>
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<tr>
<td>4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.</td>
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<td>[Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.]</td>
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<tr>
<td>[Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]</td>
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<tr>
<td><strong>Essential knowledge and skills</strong></td>
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<tr>
<td>• Describe the internal and external structures of a plant and animal and the function of each of those structures.</td>
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<td>• Explain how each structure serves various functions in growth, survival, behavior, and/or reproduction. It could include such structures as thorns, stems, roots, and colored petals for plants, and heart, stomach, lung, brain, and skin for animals.)</td>
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<tr>
<td>• Describe the interactions that occur among the structures within the plant or animal system.</td>
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<td>• Use evidence from observations of the structures of an animal or plant, to explain the function of each, and how their structures help the animal grow, survive, and/</td>
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<tr>
<td><strong>Science and Engineering Practices</strong></td>
<td><strong>Disciplinary Core Ideas</strong></td>
<td><strong>Cross Cutting Concepts</strong></td>
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<tr>
<td>Engaging in Argument from Evidence</td>
<td>LS1.A: Structure and Function</td>
<td>Systems and System Models</td>
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<tr>
<td>Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</td>
<td>Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.</td>
<td>• A system can be described in terms of its components and their interactions.</td>
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</tbody>
</table>

8/14/2015

The section entitled "Disciplinary Core Ideas" is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.
### Connections to

**Connections to other DCIs in fourth grade:** N/A


#### Common Core State Standards Connections:

**ELA/Literacy – W.4.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)

**Mathematics – 4.G.A.3** Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

### Specific Websites/Resources

- Exploring Science National Geographic (2015)
- [www.brainpop.com](http://www.brainpop.com) (license needed)

### Academic Vocabulary

- argument
- circulatory system
- conifer
- construct
- digestive system
- embryo
- external structure
- fertilization
- function
- germination
- heredity
- inherited
- internal structure
- larva
- metamorphosis
- nervous system
- nutrients
- nymph
- organ
- ovary
- ovule
- photosynthesis
- pistil
- pollen
- pollination
- pupa
- respiratory system
- roots
- seed coat
- seed dispersal
- seed leaves
- stamen
- survival
### Performance Expectations

Students who demonstrate understanding can:

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.

*Clarification Statement: Emphasis is on systems of information transfer.*

*Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.*

**Essential knowledge and skills**
- Describe how a model is used to explain that animals receive information through their senses.
- Describe how a model is used to explain that sensory information is processed in the brain.
- Explain that an animal responds to sensory information in different ways.

### Science and Engineering Practices

**Developing and Using Models**
- Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Develop a model to describe phenomena.

**Disciplinary Core Ideas**
- **LS1.D: Information Processing**
  - Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal’s brain. Animals are able to use their perceptions and memories to guide their actions.

**Cross Cutting Concepts**
- **Systems and System Models**
  - A system can be described in terms of its components and their interactions.

### Connections to

- **Articulation of DCIs across grade-bands:** MS.LS1.A; MS.LS1.D
- **Common Core State Standards Connections:** ELA/Literacy – SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

### Specific Websites/Resources
- Exploring Science National Geographic (2015)
- www.brainpop.com (license needed)

### Academic Vocabulary
- model
- process
- response
- senses
- sensory information
### EARTH AND SPACE SCIENCE

#### 4-ESS1 Earth’s Place in the Universe

**Performance Expectations**

Students who demonstrate understanding can:

**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.

[Clarification Statement: Examples of evidence from patterns could include rock layers with shell fossils above rock layers with plant fossils and no shells, indicating a change from water to land over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.]

[Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]

**Essential knowledge and skills**

- Understand that:
  - Cause-and-effect relationships are routinely identified, tested, and used to explain change.
  - Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
  - Rainfall helps to shape the land and affects the types of living things found in a region.
  - Living things affect the physical characteristics of their regions.

- Support explanations using patterns as evidence.

- Identify the evidence that supports particular points in an explanation.

- Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.) Examples of evidence from patterns could include
  - Rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time.
  - A canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.

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<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Cross Cutting Concepts</th>
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</thead>
<tbody>
<tr>
<td>Constructing Explanations and Designing Solutions</td>
<td>ESS1.C: The History of Planet Earth</td>
<td></td>
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<tr>
<td>Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</td>
<td>• Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.</td>
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</tbody>
</table>

**Patterns**

- Patterns can be used as evidence to support an explanation. (4-ESS1-1)

**Connections to Nature of Science**

- Scientific Knowledge Assumes an Order and Consistency in Natural Systems
  - Science assumes consistent patterns in natural systems.
### EARTH AND SPACE SCIENCE

#### 4-ESS2 Earth’s Systems

<table>
<thead>
<tr>
<th>Performance Expectations</th>
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</thead>
<tbody>
<tr>
<td>Students who demonstrate understanding can:</td>
</tr>
<tr>
<td>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.</td>
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</tbody>
</table>

[Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.]
### Essential Knowledge and Skills

- **Understand that:**
  - Cause-and-effect relationships are routinely identified, tested, and used to explain change.
  - Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
  - Rainfall helps to shape the land and affects the types of living things found in a region.
  - Living things affect the physical characteristics of their regions.
- **Make observations and/or measurements to produce evidence of phenomenon, such as the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.**
  - Examples of variables to test could include:
    - Angle of slope in the downhill movement of water
    - Amount of vegetation
    - Speed of the wind
    - Relative rate of deposition
    - Cycles of freezing and thawing of water
    - Cycles of heating and cooling
    - Volume of water flow

- **Understand that:**
  - Science assumes consistent patterns in natural systems.
  - Patterns can be used as evidence to support an explanation.
  - Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes.
  - The presence and location of certain fossil types indicate the order in which rock layers were formed.
- **Support explanations using patterns as evidence.**
- **Identify the evidence that supports particular points in an explanation.**

---

### Science and Engineering Practices

- **Planning and Carrying Out Investigations**
  - Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
  - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.

### Disciplinary Core Ideas

- **ESS2.A: Earth Materials and Systems**
  - Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

### Cross Cutting Concepts

- **Cause and Effect**
  - Cause and effect relationships are routinely identified, tested, and used to explain change.
  - Living things affect the physical characteristics of their regions.
The section entitled "Disciplinary Core Ideas" is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.

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<tr>
<td>Connections to other DCIs in fourth grade: N/A</td>
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<tr>
<td>Articulation of DCIs across grade-bands: 2.ESS1.C; 2.ESS2.A; 5.ESS2.A</td>
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<tr>
<td><strong>Common Core State Standards</strong></td>
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<tr>
<td>W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.</td>
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<td>Mathematics – MP.2 Reason abstractly and quantitatively.</td>
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<td>MP.5 Use appropriate tools strategically.</td>
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<tr>
<td>4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36)…</td>
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<td>4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.</td>
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<td><strong>Specific Websites/Resources</strong></td>
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<td>• Exploring Science National Geographic (2015)</td>
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<td>• <a href="http://www.brainpop.com">www.brainpop.com</a> (license needed)</td>
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<tr>
<td><strong>Academic Vocabulary</strong></td>
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<td>• angle</td>
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## Science and Engineering Practices

<table>
<thead>
<tr>
<th>Analyzing and Interpreting Data</th>
<th>Disciplinary Core Ideas</th>
<th>Cross Cutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</td>
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</tbody>
</table>
- Analyze and interpret data to make sense of phenomena using logical reasoning. | Patterns
- Patterns can be used as evidence to support an explanation. |

### Connections to other DCIs in fourth grade: N/A

### Articulation of DCIs across grade-bands:

- 2.ESS2.B
- 2.ESS2.C
- 5.ESS2.
- MS.ESS1.C
- MS.ESS2.A
- MS.ESS2.B

### Common Core State Standards

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<th>ELA/Literacy</th>
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### Performance Expectations

Students who demonstrate understanding can:

#### 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth’s features.

[Clarification Statement: Maps can include topographic maps of Earth’s land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]

**Essential knowledge and skills**

- Recognize that:
  - Patterns can be used as evidence to support an explanation.
  - Maps can help locate the different land and water features of Earth.
  - The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns.
  - Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans.
  - Major mountain chains form inside continents or near their edges.
- Support an explanation using patterns as evidence.
- Analyze and interpret data to make sense of phenomena using logical reasoning.
- Analyze and interpret data from maps to describe patterns of Earth’s features. Maps can include:
  - Topographic maps of Earth’s land
  - Topographic maps of Earth’s ocean floor
  - Locations of mountains
  - Locations of continental boundaries
  - Locations of volcanoes and earthquakes
# SCIENCE CURRICULUM Grade 4

Curriculum Writers: Caitlin Coyne and Margaret Pereira


## Performance Expectations

Students who demonstrate understanding can:

### EARTH AND SPACE SCIENCE

#### 4-ESS3 Earth and Human Activity

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

[Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; nonrenewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]

**Essential knowledge and skills**

- Understand that:
  - Energy and fuels that humans use are derived from natural sources.
  - The use of energy and fuels from natural sources affects the environment in multiple ways.
  - Some resources are renewable over time, and others are not.
- Identify cause-and-effect relationships in order to explain change.
- Obtain and combine information from books and other reliable media to explain phenomena.

## INSTRUCTIONAL STRATEGIES

RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

Mathematics - 4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

### Specific Websites/Resources

- Exploring Science National Geographic (2015)
- www.brainpop.com (license needed)
- www.beaconlearningcenter.com (lessons)

### Academic Vocabulary

- analyze
- cause and effect
- continental boundaries
- evidence
- hazards
- interpret
- interpret data
- model
- natural processes
- patterns
- prototype
- topographic

## TEACHER NOTES

See complete instructional strategies list in the introduction

## RESOURCE NOTES

See complete resource list in the introduction

## ASSESSMENT NOTES

See complete assessment list in the introduction
**Obtaining and Combining Information**

- Obtain and combine information to describe that energy and fuels are derived from natural resources and their use affects the environment.
  - Examples of renewable energy resources could include:
    - Wind energy
    - Water behind dams
    - Sunlight.
  - Examples of nonrenewable energy resources are:
    - Fossil fuels
    - Fissile materials.
  - Examples of environmental effects could include:
    - Loss of habitat due to dams
    - Loss of habitat due to surface mining
    - Air pollution from burning of fossil fuels.

**Science and Engineering Practices**

- **Obtaining, Evaluating, and Communicating Information**
  - Obtain and combine information from books and other reliable media to explain phenomena.

**Disciplinary Core Ideas**

- **ESS3.A: Natural Resources**
  - Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

**Cross-Cutting Concepts**

- **Cause and Effect**
  - Cause and effect relationships are routinely identified and used to explain change.

---

**Connections to**

- Connections to other DCIs in fourth grade: 4.ETS1.C (4-ESS3-2)

**Common Core State Standards Connections:**

- **ELA/Literacy – W.4.7** Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- **W.4.8** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- **Mathematics – MP.2** Reason abstractly and quantitatively. (4-ESS3-1),(4-ESS3-2)
### Performance Expectations

**4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.**

[Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.]

[Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

**Essential knowledge and skills**

- Recognize that:
  - Cause-and-effect relationships are routinely identified, tested, and used to explain change.
  - Engineers improve existing technologies or develop new ones to increase benefits, decrease known risks, and meet societal demands.
  - A variety of hazards result from natural processes (e.g., earthquakes, floods, tsunamis, volcanic eruptions).
  - Humans cannot eliminate the hazards, but they can take steps to reduce their impacts.
  - Research on a problem should be carried out before beginning to design a solution.
  - Testing a solution involves investigating how well it performs under a range of likely conditions.
  - At whatever stage, communicating with peers about proposed solutions to a problem is an important part of the design process, and shared ideas can lead to improved designs.
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
  - Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

- Identify and test cause-and-effect relationships in order to explain change.
### Disciplinary Core Ideas

- **Constructing Explanations and Designing Solutions**
  - Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
  - Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

- **Cause and Effect**
  - Cause and effect relationships are routinely identified, tested, and used to explain change.

- **Connections to Engineering, Technology, and Applications of Science**
  - Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1)
  - Influence of Science, Engineering and Technology on Society and the Natural World
    - Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands.

### Cross Cutting Concepts

- **ETS1.B: Designing Solutions to Engineering Problems**
  - Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)

### Connections to

- **4.ESS3.C**

### Common Core State Standards Connections:

- **ELA/Literacy** - R1.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- R1.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- **Mathematics** - MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.
## SCIENCE CURRICULUM Grade 4

Curriculum Writers: Caitlin Coyne and Margaret Pereira

### 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

<table>
<thead>
<tr>
<th>Specific Websites/Resources</th>
<th>Academic Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Exploring Science National Geographic (2015)</td>
<td>- analyze</td>
</tr>
<tr>
<td>- <a href="http://www.brainpop.com">www.brainpop.com</a> (license needed)</td>
<td>- cause and effect</td>
</tr>
<tr>
<td>- <a href="http://www.beaconlearningcenter.com">www.beaconlearningcenter.com</a> (lessons)</td>
<td>- compare</td>
</tr>
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<td>- continental boundaries</td>
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<td>- evidence</td>
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<td>- generate</td>
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<td>- hazards</td>
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<td>- interpret</td>
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<td>- model</td>
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<td></td>
<td>- multiple solutions</td>
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<td></td>
<td>- natural processes</td>
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<td></td>
<td>- patterns</td>
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<td></td>
<td>- prototype</td>
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<td>- topographic</td>
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</tbody>
</table>

### ENGINEERING and TECHNOLOGY

#### 3-5-ETS1-1 Engineering Design

**Performance Expectations**

Students who demonstrate understanding can:

**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.**

**Essential knowledge and skills**

- Understand that:
  - Possible solutions to a problem are limited by available materials and resources (constraints).
  - The success of a designed solution is determined by considering the desired features of a solution (criteria).
  - Research on a problem should be carried out before beginning to design a solution.
  - Testing a solution involves investigating how well it performs under a range of likely conditions.
  - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Apply scientific ideas to solve design problems.
- Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.)

**TEACHER NOTES**

See complete instructional strategies list in the introduction

**RESOURCE NOTES**

See complete resource list in the introduction

**ASSESSMENT NOTES**

See complete assessment list in the introduction

**REQUIRED COMMON ASSESSMENTS**

8/14/2015

The section entitled “Disciplinary Core Ideas” is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academ...
### Science and Engineering Practices

**Asking Questions and Defining Problems**
- Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.

**Disciplinary Core Ideas**

**ETS1.A: Defining and Delimiting Engineering Problems**
- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

**Cross Cutting Concepts**

**Influence of Engineering, Technology, and Science on Society and the Natural World**
- People's needs and wants change over time, as do their demands for new and improved technologies.

### Connections to 3-5-ETS1.A: Defining and Delimiting Engineering Problems include:

**Fourth Grade:** 4-PS3-4

### Articulation of DCIs across grade-bands:


### Common Core State Standards Connections:

**ELA/Literacy – W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

**W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1),(3-5-ETS1-3)

**Mathematics – MP.2** Reason abstractly and quantitatively

**MP.4** Model with mathematics.

**MP.5** Use appropriate tools strategically.

**3-5.OA** Operations and Algebraic Thinking

### Specific Websites/Resources

- Exploring Science National Geographic (2015)

### Academic Vocabulary

- design problem
- need/want
- simple design
- solutions
- specific criteria
Performance Expectations

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.

**Essential knowledge and skills**
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.
- 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.
- Recognize that:
  - Cause-and-effect relationships are routinely identified, tested, and used to explain change.
  - Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
  - Research on a problem should be carried out before beginning to design solutions.

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Cross Cutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructing Explanations and Designing Solutions</td>
<td>ETS1.B: Developing Possible Solutions</td>
<td>Influence of Engineering, Technology, and Science on Society and the Natural World</td>
</tr>
<tr>
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<td>• Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.</td>
<td>• Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.</td>
</tr>
<tr>
<td>Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.</td>
<td>• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.</td>
<td></td>
</tr>
</tbody>
</table>

**Connections to**

Connections to 3-5-ETS1.B: Designing Solutions to Engineering Problems include:

**Fourth Grade:** 4-ESS3-2


**Common Core State Standards Connections:**

ELA/Literacy -
<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>Middletown Public Schools and The Next Generation Science Standards</th>
<th>INSTRUCTIONAL STRATEGIES</th>
<th>RESOURCES</th>
<th>ASSESSMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI.5.1</td>
<td>Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</td>
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<tr>
<td>RI.5.7</td>
<td>Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</td>
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<tr>
<td>RI.5.9</td>
<td>Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.</td>
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</tr>
<tr>
<td>Mathematics –</td>
<td>MP.2 Reason abstractly and quantitatively.</td>
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<td></td>
<td>MP.4 Model with mathematics.</td>
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<td></td>
<td>MP.5 Use appropriate tools strategically.</td>
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<tr>
<td>3-5.OA</td>
<td>Operations and Algebraic Thinking</td>
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</tbody>
</table>

**Performance Expectations**

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.

**Essential knowledge and skills**

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- 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.
- Recognize that:
  - Cause-and-effect relationships are routinely identified, tested, and used to explain change.
  - Testing a solution involves investigating how well it performs under a range of likely conditions.
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
  - Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
### Science and Engineering Practices

**Planning and Carrying Out Investigations**
- Planning and carrying out investigations to answer questions or test solutions to problems in 3-5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.
  - Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

**ETS1.B: Developing Possible Solutions**
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
- ETS1.C: Optimizing the Design Solution
  - Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

### Connections to

**Comon Core State Standards Connections:**
- **ELA/Literacy – W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- **W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- **W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research.
- **Mathematics – MP.2** Reason abstractly and quantitatively.
- **MP.4** Model with mathematics.
- **MP.5** Use appropriate tools strategically.
- **3-5.OA** Operations and Algebraic Thinking

### Specific Websites/Resources

- **Exploring Science National Geographic (2015)**
- **Science Kit**

### Academic Vocabulary

- constraints
- controlled
- criteria
- failure points
- fair tests
- model/prototype
- prototype
- solutions
- variables