# Stafford Township School District

STEAM Curriculum
Grade 4

Adopted: 08/06/2017
Updated: 10/17/2018

## Philosophy

The Stafford Township Public Schools has integrated STEAM (Science, Technology, Engineering, Arts, and Math) into its elementary and intermediate school core curriculum. All Stafford students are exposed to STEAM concepts starting as early as Kindergarten and continuing throughout intermediate.

STEAM refers to the areas of Science, Technology, Engineering, Arts and Mathematics. However, STEAM initiatives are not these disciplines in isolation. Rather, STEAM is the integration of courses, programs or linked learning opportunities using an interdisciplinary approach through exploration, discovery and problem solving.

Learning by doing is inviting and exciting so students learn and remember more. Successful, hands-on experiences exploring engineering can have a major influence on motivation and confidence in learning. Ultimately, we hope to inspire students to challenge themselves and consider careers in STEAM fields. Students need STEAM project-based learning to build 21st century skills. Science and engineering jobs are growing 70 percent faster than other occupations. This means our students will be at an advantage when competing for the high-tech, high-wage jobs of the future.

| **Unit 1: Introduction to the STEAM Lab** | **Duration:** 4 Days (September) |
|---|---|

| **Standards** | |
|---|---|
| **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. |
| **9.1.4. B.1** | Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking. |
| **8.1.5.A.1** | Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems. |
| **W.4.10** | Write routinely over extended time frames (time for research, reflection, metacognition/self-correction and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **SL.4.1.B** | Follow agreed-upon rules for discussions and carry out assigned roles. |
| **SL.4.1.C** | Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. |
| **SL.4.1.D** | Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. |

| **Essential Understandings** | **Essential Questions** |
|---|---|
| *Students will understand that...*<br>● Following established STEAM Lab rules and procedures ensures that students and faculty remain safe and increases the likelihood that challenges are met successfully.<br>● Engineers take on specific responsibilities in order to contribute to the success of the overall challenge.<br>● The Engineering Design Process involves asking questions, imagining possible solutions, planning a course of action, creating and testing a process or prototype, and analyzing results in order to make design improvements. | ● How do we use the STEAM Lab flexible seating and equipment safely?<br>● How do we work together to meet our goals?<br>● What are the steps of the engineering process? |

| **Evidence of Student Learning** | |
|---|---|
| **Formative Assessments** | **Summative Assessments** |

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|---|---|
| ● Teacher Observation<br>● Conferencing<br>● Lab Journals<br>● Questioning<br>● Turn and Talk | ● Engineering projects<br>**Benchmark Assessment**<br>● Scientific Notebook Check with Scoring Rubric<br>**Alternative Assessments**<br>● Student Notebook Check with Teacher Scoring Rubric<br>● Stop and Jot Activities with possible Sentence Starters<br>● Teacher Observation Checklist based on Student Performance and Project Creation<br>● Student Participation Rubric<br>● Mystery Science Activities<br>● Student Created Project with Teacher Scoring Rubric |
| **Vocabulary** | |
| Engineering Design Process, Ask, Imagine, Plan, Create, Improve, Communicate | |
| **Knowledge and Skills** | |
| **Content** | **Skills** |
| *Students will know...*<br>● How to safely use all equipment, materials, and furniture in the STEAM Lab.<br>● Expectations of the STEAM Lab.<br>● Steps of the engineering process.<br>● Strategies for working together as a team. | *Students will be able to….*<br>● Safely use the equipment, materials, and furniture in the STEAM Lab.<br>● Work with a small group to solve a problem.<br>● Apply the engineering process to solve problems and complete engineering challenges.<br>● Identify the constraints of a challenge. |
| **Instructional Plan** | |
| **Suggested Activities** | **Resources** |
| **Discussion of Safety Rules and Lab Procedures**:<br>Using materials appropriately and following established routines ensures student safety in the lab. | ● Flexible seating expectation chart<br>● GROUPS poster |
| **Well Rescue Engineering Challenge**<br>Teamwork and the engineering design process is used to rescue a bear from the bottom of a paper tube well. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet<br>● WGBH program-Time to Invent: Rescue 911 |
| **Build a Raft Engineering Challenge** | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet |

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|---|---|
| Teamwork and the engineering design process is used to build a raft that will float while holding weight. | • More Than a Worksheet (A Raft for the Billy Goats) |
| **Pencil Holder Design Challenge**<br>The engineering design process is used to design a pencil holder to attach to a STEAM notebook. | • Criterion referenced PowerPoint Presentation<br>• Criterion referenced student activity sheet |
| **Literature** | |
| • Rosie Revere, Engineer by Andrea Beaty<br>• Ada Twist, Scientist by Andrea Beaty<br>• Iggy Peck, Architect by Andrea Beaty<br>• How Engineers Find Solutions by Reagan Miller | |
| **Websites** | |
| PBS Kids Design Squad | http://pbskids.org/designsquad/games/ |
| **Accommodations & Modifications** | |
| **English Language Learners**<br>• Shorten or simplify directions<br>• Alternative assessment<br>• Flexible/cooperative grouping<br>• Graphic organizers<br>• Native Language Support and Resources<br>• Modified classwork and homework assignments | |
| **Special Education/504 Plans**<br>• Provide differentiated instruction as needed<br>• Follow all IEP modifications/504 plan<br>• Provide manipulatives or the opportunity to draw solution strategies<br>• Modify for varying proficiency levels, multiple intelligences, and grade levels<br>• Use visuals and gestures<br>• Use sentence starters<br>• Build background knowledge<br>• Highlight key words<br>• Graphic organizers<br>• Pre-teach vocabulary, Preview lesson, Accountable Talk stems, Chunk text, Provide extra time | |

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|---|
| **Basic Skills**<br>• Modified Assignment<br>• Teacher Modeling<br>• Partner Work<br>• Teacher Prompts |
| **Economically Disadvantaged**<br>• Extra set of materials for home<br>• Study guides<br>• Modified Assignment |
| **Gifted and Talented**<br>• Higher Level Text<br>• Provide Multisyllabic Words<br>• Choice Board to extend learning<br>• Integrate a variety of activities to meet all types of multiple intelligences |
| **Students at Risk of School Failure**<br>● Alternative assessment<br>● Flexible/cooperative grouping<br>● Graphic organizers<br>● Parent-teacher communication<br>● Integrate a variety of activities to meet all types of multiple intelligences<br>● Modified classwork and homework assignments |

| **Unit 2: Land Changes** | **Duration:** 5 Days (October) |
|---|---|
| **Standards** | |
| **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-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. |
| **9.1.4. B.1** | Participate in brainstorming sessions to seek information, ideas, and strategies that foster creative thinking. |
| **8.1.4. F.1** | Select and apply digital tools to collect, organize, and analyze data that support a scientific finding. |
| **8.1.5.A.1** | Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems. |
| **W.4.10** | Write routinely over extended time frames (time for research, reflection, metacognition/self-correction and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. |
| **SL.4.1.B** | Follow agreed-upon rules for discussions and carry out assigned roles. |
| **SL.4.1.C** | Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. |
| **SL.4.1.D** | Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. |

| **Essential Understandings** | **Essential Questions** |
|---|---|
| *Students will understand that...*<br>● Weathering and erosion changes the Earth's surface slowly over time.<br>● Weathering and erosion changes landscapes and can affect people's homes.<br>● Earthquakes are caused by the shifting of tectonic plates under the Earth's surface.<br>● Engineers can construct buildings from steel to help them withstand earthquakes. Techniques to reduce the amount of sideways motion as possible is also utilized. Tall, skinny buildings are much more susceptible to earthquake damage than shorter buildings. | ● How does the Earth change?<br>● How does weathering and erosion affect our Earth?<br>● Why do earthquakes happen?<br>● How can engineers construct buildings that can withstand earthquakes? |

<table>
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<tr><td>Formative Assessments</td><td>Summative Assessments</td></tr>
<tr><td>● Teacher Observation<br>● Conferencing<br>● Lab Journals<br>● Questioning<br>● Turn and Talk</td><td>● Engineering projects<br>Benchmark Assessment<br>• Scientific Notebook Check with Scoring Rubric<br>Alternative Assessments<br>• Student Notebook Check with Teacher Scoring Rubric<br>• Stop and Jot Activities with possible Sentence Starters<br>• Teacher Observation Checklist based on Student Performance and Project Creation<br>• Student Participation Rubric<br>• Mystery Science Activities<br>• Student Created Project with Teacher Scoring Rubric</td></tr>
<tr><th colspan="2">Vocabulary</th></tr>
<tr><td colspan="2">weathering, erosion, tectonic plates, seismograph, tsunami</td></tr>
<tr><th colspan="2">Knowledge and Skills</th></tr>
<tr><td>Content</td><td>Skills</td></tr>
<tr><td>Students will know...<br>● Weathering and erosion affects people and their homes.<br>● How and where earthquakes occur.<br>● How earthquakes are measured.<br>● Engineers have improved buildings to withstand earthquakes.</td><td>Students will be able to …<br>● define the terms weathering and erosion.<br>● plan and create a design to help prevent the erosion of a beach town.<br>● explain how earthquakes occur.<br>● determine which building designs withstand earthquakes the best.</td></tr>
<tr><th colspan="2">Instructional Plan</th></tr>
<tr><td>Suggested Activities</td><td>Resources</td></tr>
<tr><td>Observing Weathering and Erosion<br>Water causes the erosion of land over time.</td><td>● Brainpop Video “Slow Land Changes”<br>● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet</td></tr>
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|---|---|
| Teamwork and the engineering design process is used to design a plan to protect a beachfront home from erosion. | • http://beakersandbumblebees.blogspot.com/2009/11/weathering-erosion-and-deposition.html |
| **Can We Prevent Erosion?**<br>Teamwork and the engineering design process is used to carry out a plan to protect a beachfront home from erosion. | • Criterion referenced PowerPoint Presentation<br>• Criterion referenced student activity sheet |
| **Exploring Earthquakes**<br>Earthquakes occur due to the shifting of tectonic plates.<br>Earthquakes can be measured by seismographs, but cannot be predicted.<br>Students will experiment with sand to understand the effects of tectonic plate shifts, track recent earthquakes on the USGS website, and use a basic seismograph. | • Criterion referenced ActiveInspire presentation.<br>• Criterion referenced student activity sheet<br>• National Geographic: https://www.youtube.com/watch?v=VSgB1IWr6O4<br>• Earthquake Tracker: https://earthquake.usgs.gov/earthquakes/map/ |
| **Earthquake Resistant Skyscrapers**<br>• The engineering design process is used to design a skyscraper that can withstand different intensities of earthquakes. | • Criterion referenced ActiveInspire Presentation<br>• Criterion referenced student activity sheet |
| **Literature** | |
| • Landforms by William Rice<br>• Tsunamis by Lisa Bullard<br>• Earthquakes by Franklyn M. Branley | |
| **Websites** | |
| USGS Earthquake tracker | https://earthquake.usgs.gov/learn/kids/ |
| Disaster Master Game | https://www.ready.gov/kids/games/data/dm-english/index.html |
| Tsunami Wall Engineering Game | http://www.physicsgames.net/game/Tsunami_Wall.html |
| BrainPop | http://www.brainpop.com |
| **Accommodations & Modifications** | |
| **English Language Learners**<br>• Shorten or simplify directions<br>• Alternative assessment<br>• Flexible/cooperative grouping<br>• Graphic organizers<br>• Native Language Support and Resources | |

- Modified classwork and homework assignments

**Special Education/504 Plans**

- Provide differentiated instruction as needed
- Follow all IEP modifications/504 plan
- Provide manipulatives or the opportunity to draw solution strategies
- Modify for varying proficiency levels, multiple intelligences, and grade levels
- Use visuals and gestures
- Use sentence starters
- Build background knowledge
- Highlight key words
- Graphic organizers
- Basic Skills- Pre-teach vocabulary, Preview lesson, Accountable Talk stems, Chunk text, Provide extra time

**Basic Skills**

- Modified Assignment
- Teacher Modeling
- Partner Work
- Teacher Prompts

**Economically Disadvantaged**

- Extra set of materials for home
- Study guides
- Modified Assignment

**Gifted and Talented**

- Higher Level Text
- Provide Multisyllabic Words
- Choice Board to extend learning
- Integrate a variety of activities to meet all types of multiple intelligences

**Students at Risk of School Failure**

- Alternative assessment
- Flexible/cooperative grouping
- Graphic organizers
- Parent-teacher communication
- Integrate a variety of activities to meet all types of multiple intelligences
- Modified classwork and homework assignments

| **Unit 3: Structure, Function, & Information Processing** | | **Duration**: 7 days (November – December) |
|---|---|---|
| **Standards** | | |
| **4PS4-2** | Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. | |
| **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. | |
| **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. | |
| **9.1.12. A.1** | Apply critical thinking and problem-solving strategies during structured learning experiences. | |
| **8.1.5.A.1** | Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems. | |
| **W.4.10** | Write routinely over extended time frames (time for research, reflection, metacognition/self-correction and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. | |
| **SL.4.1.B** | Follow agreed-upon rules for discussions and carry out assigned roles. | |
| **SL.4.1.C** | Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. | |
| **SL.4.1.D** | Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. | |
| **Essential Understandings** | | **Essential Questions** |
| *Students will know...*<br>● Light is required in order for eyes to properly function.<br>● Light enters the eye through the pupil, which changes in size to allow more or less light to enter. The image of an object is reflected onto the retina and sent to the brain for processing.<br>● Some people have blurry vision due to the distance between their pupil and cornea. A blind person might be blind due to the lack of a lens. | | ● How do eyes function?<br>● Why do some people's eyes work differently than others? |

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<tr><th colspan="2">Vocabulary</th></tr>
<tr><td colspan="2">Pupil, Iris, Retina, Reflection</td></tr>
<tr><th colspan="2">Knowledge and Skills</th></tr>
<tr><td>Content</td><td>Skills</td></tr>
<tr><td>Students will know...<br>● Eyes require light to function.<br>● Pupils get larger in the dark to allow more light in.<br>● Our eyes see images upside down and our brain flips them right-side up.</td><td>Students will be able to …<br>● Identify parts of the eye and their function.<br>● Explain how our eyes see.<br>● Explain why a pupil changes in size.<br>● Design a plan for a device that uses light and mirrors to see a hidden image.</td></tr>
<tr><th colspan="2">Instructional Plan</th></tr>
<tr><td>Suggested Activities</td><td>Resources</td></tr>
<tr><td>Our Eyes and Light<br>Our eyes have different parts with different functions. Light is necessary for eyes to see.</td><td>● Criterion referenced PowerPoint Presentation<br>● Mystery Science-What do Blind People See?</td></tr>
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|---|---|
| Students will create a model of an eye that functions the way a real eye does. | |
| **Eyes at Night**<br>Some animals are able to see well at night while others are not suited to do so.<br>Pupils adjust based on the amount of light present.<br>Students will build an eye model to better observe how the eye functions. | • Criterion referenced PowerPoint Presentation<br>• Mystery Science-How Can Some Animals See in the Dark? |
| **Mystery Number Challenge (2 sessions)**<br>Teamwork and the engineering design process is used to create a device using mirrors to view a hidden image. | • Criterion referenced PowerPoint Presentation<br>• Criterion referenced student activity sheet |
| **Literature** | |
| • Let's Investigate Light by Buffy Silverman<br>• Animals Eyes by Dona Herweck Rice<br>• Eye to Eye: How Animals See the World by Steve Jenkins | |
| **Websites** | |
| Optical Illusions | http://www.optics4kids.org/home/content/illusions/ |
| The Eye | http://www.wartgames.com/themes/humanbody/eye.html |
| Your Eyes: Kids Health | http://kidshealth.org/en/kids/eyes.html |
| **Accommodations & Modifications** | |
| **English Language Learners**<br>• Shorten or simplify directions<br>• Alternative assessment<br>• Flexible/cooperative grouping<br>• Graphic organizers<br>• Native Language Support and Resources<br>• Modified classwork and homework assignments | |
| **Special Education/504 Plans**<br>• Provide differentiated instruction as needed<br>• Follow all IEP modifications/504 plan<br>• Provide manipulatives or the opportunity to draw solution strategies<br>• Modify for varying proficiency levels, multiple intelligences, and grade levels | |

- Use visuals and gestures
- Use sentence starters
- Build background knowledge
- Highlight key words
- Graphic organizers
- Basic Skills- Pre-teach vocabulary, Preview lesson, Accountable Talk stems, Chunk text, Provide extra time

**Basic Skills**

- Modified Assignment
- Teacher Modeling
- Partner Work
- Teacher Prompts

**Economically Disadvantaged**

- Extra set of materials for home
- Study guides
- Modified Assignment

**Gifted and Talented**

- Higher Level Text
- Provide Multisyllabic Words
- Choice Board to extend learning
- Integrate a variety of activities to meet all types of multiple intelligences

**Students at Risk of School Failure**

- Alternative assessment
- Flexible/cooperative grouping
- Graphic organizers
- Parent-teacher communication
- Integrate a variety of activities to meet all types of multiple intelligences
- Modified classwork and homework assignments

| **Unit 4: Coding** | | **Duration:** January - February |
|---|---|---|
| **Standards** | | |
| **4-PS4-3** | Generate and compare multiple solutions that use patterns to transfer information. | |
| **8.1.5. A.1** | Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems. | |
| **9.1.12. A.1** | Apply critical thinking and problem-solving strategies during structured learning experiences. | |
| **8.2.4. A.1** | Investigate factors that influence the development and function of products and systems. | |
| **W.4.10** | Write routinely over extended time frames (time for research, reflection, metacognition/self-correction and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. | |
| **SL.4.1.B** | Follow agreed-upon rules for discussions and carry out assigned roles. | |
| **SL.4.1.C** | Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. | |
| **SL.4.1.D** | Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. | |
| **Essential Understandings** | | **Essential Questions** |
| *Students will understand that...*<br>● Coding is a computer language where a program gives a computer specific instruction to carry out a task.<br>● Ozobots read black or color-coded lines. They follow paths and patterns of color to perform specific tasks.<br>● Drag and drop coding allows a person to drag pre-programmed blocks in a specific order to perform a task.<br>● The 3D printing process melts and layers it into very thin layers from the bottom-up. Those thin slices stick together to form a solid object.<br>● 3D printing can be used to help solve problems, and create prototypes. It has been used in many industries ranging from automotive, fashion, and medical. | | ● What is coding?<br>● How do ozobots read code?<br>● How can we use coding to program a computer game?<br>● How does a 3D printer work?<br>● How can we use a 3D printer to meet our needs? |
| **Evidence of Student Learning** | | |
| **Formative Assessments**<br>● Teacher Observation | | **Summative Assessments**<br>● Engineering project |

<table>
<tr><td>

- Conferencing
- Lab Journals
- Questioning

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**Benchmark Assessment**

- Scientific Notebook Check with Scoring Rubric

**Alternative Assessments**

- Student Notebook Check with Teacher Scoring Rubric
- Stop and Jot Activities with possible Sentence Starters
- Teacher Observation Checklist based on Student Performance and Project Creation
- Student Participation Rubric
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</td></tr>
<tr><td colspan="2">Vocabulary</td></tr>
<tr><td colspan="2">Coding, Filament, Drag and Drop Coding, Line Coding, Computer Programmer</td></tr>
<tr><td colspan="2">Knowledge and Skills</td></tr>
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<tr><td>

*Students will know...*

- Codes have been a part of history since the first spoken and written languages.
- Computers use coding as a language to function.
- Computers need to be given specific directions by computer programmers in order to function.
- A 3D printer can be used to meet the needs of people in many industries.

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*Students will be able to …*

- Program an ozobot to perform specific tasks.
- Program a computer game figure to perform specific tasks.
- Explain how 3D printers can be used to meet the needs of people and design a project to help improve an aspect of their schools using 3D printing.
- Use critical thinking skills to solve coding puzzles as a team.

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**Introduction to Coding**
Coding is a computer language where a program gives a computer specific instruction to carry out a task.
Students will explore how coding has developed through time.
Students will program an ozobot to carry out specific tasks.

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- Criterion referenced PowerPoint Presentation
- Ozobot iPad app

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|---|---|
| **Drag and Drop Coding**<br>There are different types of computer coding programs.<br>Drag and Drop Coding and Line coding is a basic form of coding.<br>A computer will not be able to comprehend an incorrect code.<br>Students will use drag and drop coding to direct a computer character to complete a goal. | • Criterion referenced PowerPoint Presentation<br>• Candy Quest: https://www.tynker.com/hour-of-code/<br>• Lightbot:<br>• https://lightbot.com/flash.html<br>• Code Monkey: https://www.playcodemonkey.com/ |
| **3D Printing**<br>3D printing can be utilized in a variety of industries to meet the needs of a community.<br>Students will develop a plan for an object that can be 3D printed to help improve their school or community. | • Criterion referenced PowerPoint Presentation<br>• BrainPop- 3D printing<br>• Makerbot Printshop app<br>• Criterion referenced student activity sheet<br>• 3D printing by S. Otfinoski |
| **Literature** | |
| • 3D printing by Steven Otfinoski<br>• Helper Robots by Nancy Furstinger<br>• Robots by Melissa Stewart | |
| **Websites** | |
| Tinkercad | https://www.tinkercad.com/ |
| Hour of Code | https://hourofcode.com/us |
| Tynker | https://www.tynker.com/free-play/ |
| Scratch | https://scratch.mit.edu/projects/editor/?tip_bar=getStarted |
| **Accommodations & Modifications** | |
| **English Language Learners**<br>• Shorten or simplify directions<br>• Alternative assessment<br>• Flexible/cooperative grouping<br>• Graphic organizers<br>• Native Language Support and Resources<br>• Modified classwork and homework assignments | |
| **Special Education/504 Plans**<br>• Provide differentiated instruction as needed<br>• Follow all IEP modifications/504 plan<br>• Provide manipulatives or the opportunity to draw solution strategies<br>• Modify for varying proficiency levels, multiple intelligences, and grade levels | |

- Use visuals and gestures
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**Basic Skills**

- Modified Assignment
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**Economically Disadvantaged**

- Extra set of materials for home
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**Gifted and Talented**

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**Students at Risk of School Failure**

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- Graphic organizers
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- Modified classwork and homework assignments

| **Unit 5: Energy & Motion** | | **Duration:** 16 days (March – June) |
|---|---|---|
| **Standards** | | |
| **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 specific 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. | |
| **9.1.12. A.1** | Apply critical thinking and problem-solving strategies during structured learning experiences. | |
| **8.1.5.A.1** | Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems. | |
| **W.4.10** | Write routinely over extended time frames (time for research, reflection, metacognition/self-correction and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. | |
| **SL.4.1.B** | Follow agreed-upon rules for discussions and carry out assigned roles. | |
| **SL.4.1.C** | Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. | |
| **SL.4.1.D** | Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. | |
| **Essential Understandings** | | **Essential Questions** |
| *Students will understand that...*<br>● Energy is the ability to do work. Potential energy is stored energy. Kinetic energy is energy in motion.<br>● The first hill of a roller coaster is always the highest because the rollercoaster cart gets its energy from the height of the hill. A roller coaster will not have enough stored energy to go over a hill taller than the one it started at.<br>● Objects can transfer energy through collision. Some of the energy from the first object is transferred to the other. | | ● What is energy?<br>● How can you change the amount of stored energy an object has?<br>● Why is the first hill in a roller coaster always the highest?<br>● How can objects transfer energy?<br>● How does a Rube Goldberg Machine transfer and store energy?<br>● What is static electricity?<br>● What is current electricity?<br>● How can conductors and a circuit board be used control a computer app?<br>● How do light and sound energy travel? |

<table>
<tr><td>

- Static electricity is a temporary form of electricity that is caused by electrons jumping from one object to another.
- Conductors allow electricity to pass through them while insulators do not.

</td><td></td></tr>
<tr><td colspan="2">Evidence of Student Learning</td></tr>
<tr><td>Formative Assessments</td><td>Summative Assessments</td></tr>
<tr><td>

- Teacher Observation
- Conferencing
- Lab Journals
- Questioning
- Turn and Talk

</td><td>

- Engineering project

Benchmark Assessment

- Scientific Notebook Check with Scoring Rubric

Alternative Assessments

- Student Notebook Check with Teacher Scoring Rubric
- Stop and Jot Activities with possible Sentence Starters
- Teacher Observation Checklist based on Student Performance and Project Creation
- Student Participation Rubric
- Mystery Science Activities
- Student Created Project with Teacher Scoring Rubric

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<tr><td colspan="2">Vocabulary</td></tr>
<tr><td colspan="2">Potential Energy, Kinetic Energy, Circuit, Conductors and Insulators, Waves</td></tr>
<tr><td colspan="2">Knowledge and Skills</td></tr>
<tr><td>Content</td><td>Skills</td></tr>
<tr><td>

*Students will know...*

- Energy is the ability to do work or cause change.
- Difference between potential and kinetic energy.
- Rube Goldberg Machines are chain reaction machines which transfer energy from one object to another through collision.

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*Students will be able to …*

- Determine the amount of energy an object needs to reach its target.
- Make predictions about how the amount of energy an object has will change based on modifications to the object.
- Transfer energy from one object to another.
- Create static electricity.

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| ● Static electricity is a temporary form of electricity that is caused by electrons jumping from one object to another.<br>● Opposite charges are attracted to each other. Like charges will repel.<br>● Conductors allow electricity to pass through them while insulators do not.<br>● Energy can be converted from one form to another.<br>● Light and sound energy travel in waves. | ● Create a circuit to light a lightbulb<br>● Differentiate between conductors and insulators.<br>● Use a circuit board and insulators to control a computer app.<br>● Explain properties of light and sound energies. |
| **Instructional Plan** | |
| **Suggested Activities** | **Resources** |
| **Potential and Kinetic Energy**<br>Potential energy is stored energy. Kinetic energy is energy in motion.<br>The greater amount of stored energy an object has, the further it will travel.<br>Students will adjust the amount of potential energy an object has to change the distance it will travel. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet |
| **Height as Stored Energy & Energy Transfer**<br>Energy can be stored by giving an object height.<br>The higher an object is raised, the greater the amount of stored energy it will have.<br>When two objects collide, energy will be transferred from one object to the other.<br>Students will build a simple roller coaster to demonstrate stored energy and collision. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet<br>● Mystery Science: What Makes Roller Coasters Go So Fast? |
| **Hills and Stored Energy**<br>The first hill of the roller coaster is always the highest because it creates the stored energy the coaster car requires to progress through the ride.<br>Students will build a rollercoaster with hills and compare how the energy of a marble changes at different points of the ride. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet<br>● Mystery Science: Why is the First Hill of a Roller Coaster Always the Highest? |
| **Rube Goldberg Machines (2 sessions)** | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet<br>● OK Go Music Video (This Too Shall Pass) |

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| Students will plan a chain reaction machine that will help to carry out a simple task in a complicated way by transferring the energy of one colliding object to another. | |
| **Static Electricity Stations**<br>Static electricity is the result of an imbalance between negative and positive charges in an object.<br>Students will create a positive or negative charge on a variety of objects to demonstrate the phenomenon of static electricity. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet |
| **Light a Bulb**<br>Current electricity is the steady flow of electrons through a circuit.<br>Students will build a simple circuit with a power source and a load. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet |
| **Conductors, Insulators, and Switches**<br>Conductors allow electricity to flow through them, insulators do not.<br>Series and parallel circuits differ in function and practicality.<br>Switches provide a safe and easy way to open and close a circuit. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet |
| **Makey Circuits**<br>Water is a conductor of electricity. Since 60% of the human body is water, people also make good conductors of electricity.<br>Students will create a game controller using a circuit board, conductors, a computer and their knowledge of current electricity. | ● Makey Makey Scratch Apps |
| **Light Energy Stations**<br>Light energy is the only form of energy we can see directly.<br>Students will observe the properties of reflection, refraction, and the visible light spectrum. | ● Criterion referenced PowerPoint Presentation<br>● Criterion referenced student activity sheet |
| **Sound Energy: Cup Telephones**<br>Sound energy is caused by vibrations and travels in sound waves.<br>Students will observe how sound can travel through string and cups and work to design a better cup telephone model. | ● Criterion referenced PowerPoint Presentation<br>● Mystery Science: How Far Can a Whisper Travel?<br>● Mystery Science activity sheet |
| **Sound Energy Stations: Volume and Pitch** | ● Criterion referenced PowerPoint Presentation<br>● https://www.youtube.com/watch?v=snwqR4ccxQs |

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| A sound with a louder volume will have a taller amplitude. A sound with a higher pitch will have a greater frequency. Students will explore how to change the volume and pitch of different objects. | • -Criterion referenced PowerPoint Presentation<br>• http://www.dangerousdecibels.org/virtualexhibit/<br>• https://www.nidcd.nih.gov/health/interactive-sound-ruler-how-loud-too-loud<br>• http://www.bbc.co.uk/schools/scienceclips/ages/9_10/changing_sounds.shtml |
| **Sound-Reducing Boxes**<br>Students will design a container to reduce the amount of sound coming from a ringing cellular phone. | • Criterion referenced PowerPoint Presentation<br>• Criterion referenced activity sheet. |
| **Literature** | |
| • STEM Jobs in Music by Shirley Duke<br>• Understanding Sound by Tamra B. Orr<br>• Let's Investigate Light by Buffy Silverman<br>• Matter and Energy: Finding the Power by Emily Sohn and Nina Tsang<br>• What is Energy by Andrew Einspruch<br>• Energy in Action by Suzanne Barchers<br>• Electricity for the Future by Eileen Byrne<br>• Energy All Around by Buffy Silverman<br>• What is a Circuit by Ethan Weingarten | |
| **Websites** | |
| Makey Makey Apps | http://makeymakey.com/apps/ |
| Electricity and Energy | http://interactivesites.weebly.com/electricity-and-energy.html |
| Energy Star Kids | https://www.energystar.gov/index.cfm?c=kids.kids_index |
| **Accommodations & Modifications** | |
| **English Language Learners**<br>• Shorten or simplify directions<br>• Alternative assessment<br>• Flexible/cooperative grouping<br>• Graphic organizers<br>• Native Language Support and Resources<br>• Modified classwork and homework assignments | |

**Special Education/504 Plans**

- Provide differentiated instruction as needed
- Follow all IEP modifications/504 plan
- Provide manipulatives or the opportunity to draw solution strategies
- Modify for varying proficiency levels, multiple intelligences, and grade levels
- Use visuals and gestures
- Use sentence starters
- Build background knowledge
- Highlight key words
- Graphic organizers
- Basic Skills- Pre-teach vocabulary, Preview lesson, Accountable Talk stems, Chunk text, Provide extra time

**Basic Skills**

- Modified Assignment
- Teacher Modeling
- Partner Work
- Teacher Prompts

**Economically Disadvantaged**

- Extra set of materials for home
- Study guides
- Modified Assignment

**Gifted and Talented**

- Higher Level Text
- Provide Multisyllabic Words
- Choice Board to extend learning
- Integrate a variety of activities to meet all types of multiple intelligences

**Students at Risk of School Failure**

- Alternative assessment
- Flexible/cooperative grouping
- Graphic organizers
- Parent-teacher communication
- Integrate a variety of activities to meet all types of multiple intelligences
- Modified classwork and homework assignments

Stafford Township School District
STEAM
Pacing Guide
Grade 4

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| Unit 1<br>Introduction to the STEAM Lab | 4 Days<br>September |
| Unit 2<br>Land Changes | 5 Days<br>October |
| Unit 3<br>Structure, Function, and Information Processing | 7 Days<br>November - December |
| Unit 4<br>Coding | 8 Days<br>January – February |
| Unit 5<br>Energy and Motion | 16 days<br>March – June |