Stafford Township School District

STEAM Curriculum
Grade 5

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: STEAM Lab Orientation	**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.
CPI 9.1.4. A.1	Recognize a problem and brainstorm ways to solve the problem individually or collaboratively.
CPI 9.1.4. A.2	Evaluate available resources that can assist in solving problems.
CPI 9.1.4. C.1	Practice collaborative skills in groups, and explain how these skills assist in completing tasks in different settings.
W.5.10	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.5.1.B	Follow agreed-upon rules for discussions and carry out assigned roles.
SL.5.1.C	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
SL.5.1.D	Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

Essential Understandings	**Essential Questions**
Students will understand that... ● Following established STEAM Lab rules and procedures ensures that students and faculty remain safe and increases the likelihood that challenges are met successfully. ● Engineers take on specific responsibilities in order to contribute to the success of the overall challenge. ● The Engineering Design Process involves asking questions, imagining possible solutions, planning a course of action,	● How do we use the STEAM Lab equipment safely? ● How do we work together to meet our goals? ● What are the steps of the Engineering Design Process (EDP)?

<table>
<tr><td colspan="2">creating and testing a process or prototype, and analyzing results in order to make design improvements.</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
● Question and Answer
● Conferencing</td><td>● STEAM Lab Rubric
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</td></tr>
<tr><td colspan="2">Vocabulary</td></tr>
<tr><td colspan="2">Analyze, Constraints, Criteria, Engineering Design Process, Prototype, Redesign</td></tr>
<tr><td colspan="2">Knowledge and Skills</td></tr>
<tr><td>Content</td><td>Skills</td></tr>
<tr><td>Students will know:
● Engineers describe a problem that can be solved through the development of an object, tool, process, or system.
● Engineers identify which individuals or groups need this problem to be solved.
● Engineers define constraints that must be taken into account in the solution.
● Engineers identify how each solution would solve the problem.
● Engineers compare solutions based on the results of their performance against the defined criteria and constraints.</td><td>Students will be able to …
● utilize safely the equipment, materials, and furniture in the STEAM Lab.
● choose a job that allows them to contribute to the challenge activity.
● apply the Engineering Design Process (EDP) to create a pipe cleaner bridge capable of supporting two ping pong balls inside a paper cup.</td></tr>
</table>

Instructional Plan	
Suggested Activities	**Resources**
• Discussion of Safety Rules and Lab Procedures - Students will be oriented on how materials should be used and stored, how to safely sit on the Hoky stools, and what jobs are available for cooperative learning.	• Rules, lab procedures, and team jobs are posted on bulletin boards. • https://www.nsf.gov/news/classroom/engineering.jsp
• Pipe Cleaner Bridges - Students will work in teams to create a bridge from pipe cleaners strong enough to hold a golf ball inside a paper cup.	• *50 More STEM Labs* by Andrew Frinkle, p. 21
Literature	
• *Hit It! History of Tools* - Donna H. Rice • *Inventions and Inventors* - Darren Sechrist • *Play it Safe Online* - Phyllis Cornwall	
Websites	
• https://www.teachengineering.org/ (resource for engineering projects and activities)	
• http://stemcollaborative.org/additionalResources.html (resource of STEM activities)	
• https://www.nsf.gov/news/classroom/engineering.jsp (National Science Foundation engineering classroom resources)	
Accommodations & Modifications	
English Language Learners • Shorten or simplify directions • Alternative assessment • Flexible/cooperative grouping • Graphic organizers • 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 2: Structures and Properties of Matter	**Duration:** 7 Days (October-November)
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.
5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.
5-PS1-3	Make observations and measurements to identify materials based on their properties.
CPI# 9.1.8. A.1	Develop strategies to reinforce positive attitudes and productive behaviors that impact critical thinking and problem-solving skills.
Technology 8.2.8. B.3	Solve a science-based design challenge and build a prototype using science and math principles throughout the design process.
W.5.10	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.5.1.B	Follow agreed-upon rules for discussions and carry out assigned roles.
SL.5.1.C	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
SL.5.1.D	Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
Essential Understandings	**Essential Questions**
Students will understand that… ● Engineers take on specific responsibilities in order to contribute to the success of the overall challenge. ● Following the steps of the EDP helps engineers to work in an organized fashion to better understand failures and correct them. ● Matter can be identified by its physical and chemical properties. Chemical properties are revealed when the atomic structure of matter changes.	● How do we work together to meet our goals? ● How do we apply the EDP to solve problems? ● How do the physical properties of matter help us to identify different kinds of matter? ● What is the difference between chemical and physical changes to matter? ● How can I describe matter when it is made up of particles too small to be seen?

● Models help us to understand the structure of matter although it is made of particles too small to be seen.	

Evidence of Student Learning

Formative Assessments	**Summative Assessments**
● Teacher Observation ● Question and Answer ● Conferencing	● STEAM Lab Rubric **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

Vocabulary

Atom, Electron, Matter, Mass, Neutron, Properties, Proton, States of Matter, Substances, Weight

Knowledge and Skills

Content	**Skills**
Students will know that... ● Engineers describe a problem that can be solved through the development of an object, tool, process, or system. ● Engineers identify which individuals or groups need this problem to be solved. ● Engineers define constraints that must be taken into account in the solution. ● Engineers identify how each solution would solve the problem. ● Engineers compare solutions based on the results of their performance against the defined criteria and constraints.	*Students will be able to...* ● collaborate in teams to use the physical properties of matter to differentiate between 4-5 white powders. ● explain why tasting is not using a physical property to identify the powders. ● contribute to a team that applies the EDP to create a balloon-powered racer capable of traveling at least 3 meters. ● collaborate on a team that applies the EDP to design a model of an atom or molecule given random objects and materials.

• When two or more different substances are mixed, a new substance with different properties may be formed. A chemical reaction must occur for this to happen. • Bubbling, color changes, release of heat or flame are indicators that a chemical reaction has occurred. • The taste of a substance is a chemical property, not a physical one. It is dangerous to taste unknown substances.	
Instructional Plan	
Suggested Activities	**Resources**
• White Powder Challenge - Students will use physical properties such as crystalline structure, odor, color, and texture, to identify five common, non-toxic white powders.	• http://interactivesites.weebly.com/matter-chemical-physical.html • YouTube video - *Properties of Matter-Physical and Chemical Properties*
• "Gas" Powered Cars - Students will design, build, and race cars that run on the gas expelled from a balloon.	• *STEM Labs for Middle Grades* -Mark Twain Media, page 18
• Atom/Molecule Models - Students will use a variety of materials to build a model of an atom or simple molecule. This will be a multiple session challenge.	
Literature	
• *Changing Matter: Understanding Physical and Chemical Changes* - Tracy Nelson • *Crystals* - Louise and Richard Spilsbury • *The Solid Truth About Matter* - Mark Weakland	
Websites	
• http://classroom.jc-schools.net/sci-units/matter.htm (several lessons to address Physical Changes, Measurement, Changes in Matter)	
• http://interactivesites.weebly.com/matter-chemical--physical.html (links to interactive activities on Matter: Physical and Chemical Changes)	
• http://www.middleschoolchemistry.com/multimedia/chapter1/lesson2 (Molecular Motion Models)	
Accommodations & Modifications	

English Language Learners

- Shorten or simplify directions
- Alternative assessment
- Flexible/cooperative grouping
- Graphic organizers
- 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: Matter and Energy in Organisms and Ecosystems	**Duration:** 12 Days (December-February)
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.
5-PS3-1	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
5-LS1-1	Support an argument that plants get the materials they need for growth chiefly from air and water.
5-LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
CPI 9.1.12. F.2	Demonstrate a positive work ethic in various settings, including the classroom and during structured learning experiences.
NJSLS.RI.5.7	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.
W.5.10	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.5.1.B	Follow agreed-upon rules for discussions and carry out assigned roles.
SL.5.1.C	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
SL.5.1.D	Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

<table>
<tr><th>Essential Understandings</th><th>Essential Questions</th></tr>
<tr><td>Students will understand that...
Our sun is the primary source of energy on Earth.
Energy released from food was once energy from the sun that was captured by plants in the chemical process called photosynthesis.</td><td>What is the initial source of energy in every ecosystem?
How do the structures of plants and animals allow them to extract food and energy from their environments?</td></tr>
<tr><td colspan="2">Evidence of Student Learning</td></tr>
<tr><td>Formative Assessments.</td><td>Summative Assessments</td></tr>
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Student Participation Rubric
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Student Created Project with Teacher Scoring Rubric</td></tr>
<tr><td colspan="2">Vocabulary
Adaptations, Chemical Change, Consumers, Cycles, Decomposers, Ecosystem, Food Web, Producers, Recycle, Specialized Structures</td></tr>
<tr><td colspan="2">Knowledge and Skills</td></tr>
<tr><td>Content</td><td>Skills</td></tr>
<tr><td>Students will know that...
A healthy ecosystem is one in which multiple species of different types are able to meet their needs in a relatively stable web of life.
Specialized structures help plants and animals to thrive in their ecosystems.
Plants have specialized structures that allow them to get nutrients from the air, water, and soil - but mostly from air</td><td>Students will be able to …
contribute to a team that applies the EDP to create a tree from tissue paper that will remain implanted in sand when a gust of wind rushes by.
participate on a team to create an original creature with the appropriate adaptations to survive in an assigned environment.</td></tr>
</table>

and water. These structures can also help plants to sustain severe weather conditions and reproduce. ● Organisms are related in food webs in which some animals eat plants for food while other animals eat the animals that eat plants. Decomposers restore some materials back to the soil. ● Organisms can survive only in environments in which their particular needs are met.	● collaborate on a team that applies the EDP to design an original watering can for a particular purpose. ● contribute to a team that applies the EDP to design a bird beak that allows the students to pick up as much food as possible in one try without using their hands.
Instructional Plan	
Suggested Activities	**Resources**
Wind Resistant Tree Challenge - Students will manipulate tissue paper to create a tree with roots strong enough to withstand a strong wind gust when planted into a bucket of sand.	● http://www.internet4classrooms.com/science elem plants.htm
Create a Creature Challenge - Students will create an original animal that has adaptations allowing it to survive in a particular ecosystem.	● http://earthobservatory.nasa.gov/Experiments/Biome/index.php ● http://www.ucmp.berkeley.edu/glossary/gloss5/biome/
Design a Better Watering Can - Students will design a new type of watering can that adapts to a variety of situations. Students may use different media to represent their designs - paper, clay, computer animation, etc.	● http://www.internet4classrooms.com/science elem plants.htm
Build-a-Beak Challenge - Students will use a variety of materials to create a bird's beak that will pick up as much food as possible in a single feeding.	● www.curiositymachine.org
Literature	
● *Matter and Energy: Finding the Power* - Emily Sohn and Nina Tsang ● *Why Plants Become Extinct* - Julie K. Lundgren ● *You Wouldn't Want to Live Without Insects!* - Anne Rooney	
Websites	
● http://www.history.com/videos/aztec-ingenuity#aztec-ingenuity (learn how early Aztec chinampas were the precursor to hydroponics)	
● http://concord.org/stem-resources/experiment-ecosystems (modeling interdependence)	
● http://www.harcourtschool.com/activity/food/food_menu.html (interactive food web)	

Accommodations & Modifications
English Language Learners • Shorten or simplify directions • Alternative assessment • Flexible/cooperative grouping • Graphic organizers • 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 4: Space Systems: Stars and the Solar System	**Duration:** 7 Days (March-April)

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.
5-PS2-1	Support an argument that the gravitational force exerted by Earth on objects is directed down.
5-ESS1-1	Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.
5-ESS1-2	Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.
Technology 8.2.8. B.1	Design and create a product using the design process that addresses a real-world problem with specific criteria and constraints.
NJSLS.W.5.7	Conduct short research projects that use several sources to build knowledge through investigation of different perspectives of a topic.
W.5.10	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.5.1.B	Follow agreed-upon rules for discussions and carry out assigned roles.
SL.5.1.C	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
SL.5.1.D	Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

Essential Understandings	**Essential Questions**
Students will understand that... ● The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. ● Energy is transferred but never destroyed.	● How does the force of gravity impact life on Earth? ● Why does the sun appear brighter than other stars? ● How can we harness the energy of the sun?

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<tr><td>

- The sun is a star that appears larger and brighter than other stars because it is closer.
- New technologies are allowing mankind to better utilize and store energy from the sun.

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

- Teacher Observation
- Question and Answer
- Conferencing

</td><td>

- STEAM Lab Rubric

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
Day, Drag, Energy Transfer, Gravitational Force, Month, Orbit, Revolution, Rotation, Star, Sun, Thrust, Year</td></tr>
<tr><td colspan="2">Knowledge and Skills</td></tr>
<tr><td>Content</td><td>Skills</td></tr>
<tr><td>

Students will know:

- Gravity helps to convert potential energy to kinetic energy.
- Newton’s Third Law of Motion applies to the launch of a rocket: the thrust of hot gas toward the ground results in a movement away from Earth’s surface.
- Rocket thrusts in space can change the direction and speed of spacecraft.
- The age of a star can determine its color and therefore how easily it is perceived from Earth. Certain colors are more easily seen from a distance than others.

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Students will be able to …

- strategize with a team that applies the EDP to create a Rube Goldberg machine that uses gravitational force to begin a chain of at least four energy transfers.
- collaborate on a team that applies the EDP to create a balloon-powered rocket to launch the greatest payload possible to the classroom ceiling.
- participate on a team to devise an experiment to determine which light colors are easiest to perceive from a distance.

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<tr><td>

- Stars range greatly in their distance from Earth. This also affects how easily a star is perceived from Earth.
- The sun produces heat and electromagnetic radiation. Electromagnetic radiation includes visible, ultraviolet, and infrared light as well as x-rays and radio waves.
- When the sun's rays enter layers of air or glass but cannot escape, the temperature inside those layers continues to increase. This is known as the "greenhouse effect."

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- contribute to a team that applies the EDP to create a solar oven that can melt cheese or chocolate.

</td></tr>
<tr><td colspan="2">Instructional Plan</td></tr>
<tr><td>Suggested Activities</td><td>Resources</td></tr>
<tr><td>Rube Goldberg Machines - Students will design and create a simple Rube Goldberg machine that has at least 4 energy transfers.</td><td>

- YouTube video entitled Simple Rube Goldberg Machines: BigGameTommy
- STEM Labs for Middle Grades -Mark Twain Media, page 16

</td></tr>
<tr><td>Rocket Lift Challenge - Students will design and build a balloon rocket capable of delivering the largest possible payload to the classroom ceiling.</td><td>

- STEM Labs for Middle Grades by Schyrlet Cameron and Carolyn Craig, p. 41

</td></tr>
<tr><td>Color Perception Experiment - Students will design an experiment to determine which light colors can be seen most easily from a distance.</td><td>

- http://www.kidsastronomy.com/solar_system.htm

</td></tr>
<tr><td>Solar Ovens - Students will design and build solar ovens capable of melting cheese or chocolate.</td><td>

- STEM Labs for Middle Grades by Schyrlet Cameron and Carolyn Craig, p. 44
- https://www.homesciencetools.com/a/build-a-solar-oven-project

</td></tr>
<tr><td colspan="2">Literature</td></tr>
<tr><td colspan="2">

- The Solar System, Meteors, and Comets - Clive Gifford
- All About Space Stations - Miriam Gross
- The Universe, Black Holes, and the Big Bang - Clive Gifford

</td></tr>
<tr><td colspan="2">Websites</td></tr>
<tr><td colspan="2">

- http://stem-talk.weebly.com/sample-lessons.html (STEM Space Lessons)

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<tr><td colspan="2">

- http://amazing-space.stsci.edu/resources/explorations/index.shtml (resources for lessons on space)

</td></tr>
</table>

- dsastronomy.com/solar_system.htm (planet information and resources)

Accommodations & Modifications

English Language Learners

- Shorten or simplify directions
- Alternative assessment
- Flexible/cooperative grouping
- Graphic organizers
- 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 5: Earth's Systems		**Duration:** 6 Days (May-June)
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.	
5-ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.	
CPI# 9.1.4. A.5	Apply critical thinking and problem-solving skills in classroom and family settings.	
NJSLSA.R.7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.	
W.5.10	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.5.1.B	Follow agreed-upon rules for discussions and carry out assigned roles.	
SL.5.1.C	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.	
SL.5.1.D	Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.	
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.	
Essential Understandings		**Essential Questions**

<table>
<tr><td>Students will understand that ...
Less than 1% of Earth’s water is potable and easily accessible. To purify sewage water for reuse requires several steps.
Global warming is melting frozen water at Earth’s poles, causing sea levels to rise.
Earth’s major systems are the geosphere, hydrosphere, atmosphere, and biosphere. These systems interact in a variety of ways that affect Earth’s surface materials and processes.
Humans must develop new technologies to help counteract and cope with climate change.</td><td>What percentage of Earth’s water is potable?
How is water purified in nature?
What systems do humans use to purify water?
How does global climate change affect Earth’s water resources?
How do the geosphere, biosphere, hydrosphere, and/or atmosphere interact?
How do individual communities use science ideas to protect the Earth’s resources and environment?</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
Question and Answer
Conferencing</td><td>STEAM Lab Rubric
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</td></tr>
<tr><td colspan="2">Vocabulary
Atmosphere, Biosphere, Freshwater, Geosphere, Hydrosphere, Interact, Landforms, Potable, Saltwater, System</td></tr>
<tr><td colspan="2">Knowledge and Skills</td></tr>
<tr><td>Content</td><td>Skills</td></tr>
<tr><td>Students will know that...
Most of Earth’s water is in the ocean and much of Earth’s freshwater is in glaciers or underground.</td><td>Students will be able to …
collaborate on a team that applies the EDP to create a water filtering system.</td></tr>
</table>

• New technologies are finding ways to purify and recycle fresh water. • Winds and clouds in the atmosphere interact with landforms to determine patterns of weather. The latitude of a land mass can also affect its climate. • Large bodies of water can moderate the temperatures of the land masses they border. • Graphing data can help us to see trends and patterns and therefore to draw conclusions. • Air is a combination of different gases, and some gases are lighter than air. • Newton's First Law of Motion is the foundation of neutral buoyancy.	• cooperate in groups to use US weather data to determine if large bodies of water help to moderate monthly temperatures. • strategize with teams to get a mylar balloon to hover in midair for 10 seconds (eg. find its neutral buoyancy) and then to travel a specific path using only air currents.
Instructional Plan	
Suggested Activities	**Resources**
Water Filter Challenge - Students will design and build water filters using plastic water bottles and a variety of filtering materials.	• JPL Education - NASA Website • *STEM Labs for Middle Grades* by Schyrlet Cameron and Carolyn Craig, p.55
Using US Weather Data to Draw Conclusions - Students will graph weather data to determine if large bodies of water really do moderate the temperatures of adjacent land masses.	• *Summary of Monthly Normals (2010)* from www.ncdc.noaa.gov.
Sky Floater Challenge - Students will experiment with small weights until they achieve neutral buoyancy for a floating mylar balloon.	• PBS - Design Squad Teacher's Guide, *Breezy Blimps.*
Literature	
• *The Science of a Flood* - Meg Marquardt • *Oceans* - Peter Benoit • *Earth Materials: The Mystery of Rocks* - Emily Sohn and Pam Wright	
Websites	
• https://sites.google.com/a/msad60.org/k-5_science/fifth-grade/earth-systems (5th Grade Earth Systems)	
• http://www.crscience.org/lessonplans/5_FollowtheRiver_Penny_1112.pdf (Follow the River to Clean Water)	

- http://www.ciese.org/curriculum/tempproj/ - (The Global Sun Temperature Project)
- http://www.nrdc.org/reference/kids.asp - (Natural Resources for Kids)

Accommodations & Modifications

English Language Learners

- Shorten or simplify directions
- Alternative assessment
- Flexible/cooperative grouping
- Graphic organizers
- 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 6: Math and Art Projects	**Duration:** Ongoing

Standards	
NJSLS-5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume and measurement.
NJCCCS-Visual and Performing Arts-1.1	The Creative Process: All students will demonstrate an understanding of the elements and principles that govern the creation of works of art in dance, music, theatre, and visual art.
NJCCCS-Visual and Performing Arts-1.2	History of the Arts and Culture: All students will understand the role, development, and influence of the arts throughout history and across cultures.
NJSLS-5.NF.B.5	Interpret multiplication as scaling (resizing).
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.
W.5.10	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.5.1.B	Follow agreed-upon rules for discussions and carry out assigned roles.

SL.5.1.C	Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
SL.5.1.D	Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

Essential Understandings	**Essential Questions**
Students will understand that... ● Solid figures are three-dimensional shapes that have faces, edges, and vertices. ● The faces of non-curved solid figures are made of polygons. ● There are three major categories of tessellations. ● Tessellation artwork is found in architecture and fashion. ● Equivalent fractions, or proportions, can help us find missing dimensions and the appropriate scale for models.	● What are the characteristics of solid figures? ● What are the similarities and differences among two-dimensional polygons and solid figures? ● What are tessellations and what are the major categories of tessellations? ● How are tessellations used in art and architecture? ● How can proportional reasoning help us to create scale models?

Evidence of Student Learning

Formative Assessments.	**Summative Assessments**
● Teacher Observation ● Question and Answer ● Conferencing	● STEAM Lab Rubric **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

<table>
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<tr><td colspan="2">Acceleration, Aerospace Engineer, Axis, Celestial Body, Eclipse, Galaxy, Gravitational Pull, Orbit, Propulsion, Seasons, Solar Sail, Universe</td></tr>
<tr><th colspan="2">Knowledge and Skills</th></tr>
<tr><th>Content</th><th>Skills</th></tr>
<tr><td>Students will know that...
Volume is an attribute of solid figures.
Solid figures having regular polygon faces are often used as holiday ornaments.
Tessellations are patterns created from shapes that fit together without gaps or overlaps.
Tessellations are generally made from regular polygons. There are three kinds of regular tessellations and eight kinds of semi-regular tessellations.
M.C. Escher was a Dutch graphic artist who lived from 1898 until 1972. He created tessellations using real-world objects.
Proportions are pairs of equivalent fractions. Open proportions can help us to find the size-scale factor between two objects.
Once we know the size-scale factor, we can create scale models of the original object. These models can be larger or smaller than the original.</td><td>Students will be able to …
create a three-dimensional decoration.
identify Escher-style tessellations.
create their own Escher-style tessellations.
collaborate on a team that applies the EDP to construct a kite model one half the size of the original.</td></tr>
<tr><th colspan="2">Instructional Plan</th></tr>
<tr><th>Suggested Activities</th><th>Resources</th></tr>
<tr><td>Solid Figure Decoration - Students will decorate and then assemble the nets of solid figures.</td><td>Hands on Math Projects with Real-Life Applications by Judith A. Muschla and Gary Robert Muschla</td></tr>
<tr><td>Escher-style Tessellations - Students will tessellate an original tile and then add details to create an Escher-style art piece.</td><td>6th-grade level of the Everyday Math Student Handbook, p. 207.</td></tr>
<tr><td>Scale Kite Challenge - Students will use proportional reasoning to create a kite that is one-half the size of the original.</td><td>https://www.teachengineering.org/activities/view/build_a_scale_model</td></tr>
<tr><th colspan="2">Literature</th></tr>
</table>

- *Did it Take Creativity to Find Relativity, Albert Einstein?* - Melvin and Gilda Berger
- *The Woman Who Invented the Thread That Stops Bullets: The Genius of Stephanie Kwolek* - Edwin B. Wyckoff
- *Leonardo Da Vinci* - Mike Venezia

Websites

- https://www.ciese.org/materials/k12/ (resource for STEM based lessons and projects)
- http://stemcoolaborative.org/additionalResources.html (STEM resources readily available on the web)
- https://www.brainpop.com (resource for collaborative lessons, games, and projects)

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Stafford Township School District
STEAM
Pacing Guide
Grade 5

Unit 1 Orientation	4 Days September
Unit 2 Structures and Properties Of Matter	7 Days October - November
Unit 3 Matter and Energy in Organisms and Ecosystems	12 Days December – February
Unit 4 Space Systems	7 Days March - April
Unit 5 Earth's Systems	6 Days May - June
Unit 6 Math and Art Projects	6 Days Ongoing