Revised 2019

Glen Ridge Board of Education
STEM 7
Grade Level
Elective
Semester

New Jersey Student Learning Standards

Written by: Sean McLearie

Science Mission Statement:

The Glen Ridge Public School's science curriculum seeks to inspire scientifically-literate citizens who will be able to participate in a dynamic global community. Our program fosters a spirit of intellectual curiosity and collaborative problem solving that is innovative, experiential, thought-provoking, and developmentally appropriate. Our students will use scientific methodology to evaluate and critique global issues relating to Life Sciences, Physical Sciences, The Sciences of Earth & Space, and Engineering Sciences. Students will be challenged and will be encouraged to take risks and develop critical scientific thinking skills.

Course Description:

This project-based course will provide students with the opportunity to engage in collaborative learning by incorporating Science, Technology, Engineering, and Mathematics concepts into the design and construction of various projects that will be scored based on how effectively they perform a given role or function once they are complete. Students will work collectively in groups and compete against the other student groups. Grades will be based on how each group's project performs against a set of standards and/or the other student projects.

Unit 1: Build a Radio Tower
Time Allotted (days of instruction): 6
New Jersey Student Learning Standards (NJSLS)
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
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Essential Questions	Student Learning Objectives	Activities
● Which geometric shapes are most often used in tower design and why? ● How does the design of your tower affect its ability to remain standing? ● What could you have done differently to make your radio tower taller?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Brainstorm and design a radio tower to be built as tall as possible without falling over. ● Explain why your design worked well or did not work well.	● Construct your radio tower using only spaghetti and adhesive. ● Measure and record the height of your radio tower and compare it to the other group's towers. ● Reflect upon the success of your radio tower compared with the other groups and present design adjustments.
Resources/Materials	• Google Classroom • Assorted construction materials	
Interdisciplinary Connections	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. MP.2 Reason abstractly and quantitatively. 6.3 Active Citizenship in the 21st Century- All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world. 8.1 Computer and Information Literacy- All students will use computer applications to gather and organize information and to solve problems. 8.2 Technology Education- All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.	
21st Century Life and Careers	9.1: 21st Century Life & Career Skills- All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.	

Technology Standards	8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create communication knowledge.

Assessments			
Formative	**Summative**	**Benchmarks**	**Alternative**
● Teacher observation ● Think/Pair/Share	● Verbal Assessment ● Progress reports	● Project presentation	● Research paper

Modifications		
English Language Learners	**Special Education/504**	**Gifted and Talented**
● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the tower.

S.T.E.M. 7
Unit 2: Design a Lunar Thermos
Time Allotted (days of instruction): 6
New Jersey Student Learning Standards (NJSLS)
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
(TO ADD MORE ROWS, RIGHT CLICK AND CHOOSE INSERT ROW BELOW)

Essential Questions	**Student Learning Objectives**	**Activities**
● What materials work best to prevent the transfer of heat into or out of a substance? ● What design works best to prevent the transfer of heat into or out of a substance? ● Is it possible to keep a substance at the same temperature for a prolonged period of time? ● Will the temperature of the liquid in the thermos eventually reach the same temperature as the air in the room?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Brainstorm and design a protective insulating layer to keep a cup of hot water, and a cup of cold water, at relatively constant temperatures. ● Test the effectiveness of your thermos design over time. ● Explain why your design worked well or did not work well.	● Record the initial and final temperature of a cup of hot water and a cup of cold water over a 10 minute time period. ● Pre-determine what volume is optimal for your lunar thermos design. ● Pre-determine what starting temperature is optimal for your liquid. ● Construct your lunar thermos using the available materials. ● Graph the temperature change vs time for both the hot and cold water in your thermos.
Resources/Materials	• Google Classroom • Assorted construction materials	

Interdisciplinary Connections	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. MP.2 Reason abstractly and quantitatively. 6.3 Active Citizenship in the 21st Century- All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world. 8.1 Computer and Information Literacy- All students will use computer applications to gather and organize information and to solve problems. 8.2 Technology Education- All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.
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Assessments			
Formative	**Summative**	**Benchmarks**	**Alternative**
● Teacher observation ● Think/Pair/Share	● Verbal Assessment ● Progress reports	● Project presentation	● Research paper

Modifications

English Language Learners	Special Education/504	Gifted and Talented
● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the thermos.

Unit 3: Build a Lunar Buggy
Time Allotted (days of instruction): 9
New Jersey Student Learning Standards (NJSLS)
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
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Essential Questions	Student Learning Objectives	Activities

● What is the ideal design for a wheeled vehicle that will carry a payload the maximum distance? ● Did the cargo mass make a difference in your buggy's performance? ● How did the slope of the ramp affect your buggy's performance? ● What could you have done differently to make your Lunar Buggy work better?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Brainstorm and design a lunar buggy according to given requirements that will carry a payload down a ramp. ● Determine the best slope of the ramp for the rover to travel the farthest distance. ● Explain why your design worked well or did not work well.	● Watch the Apollo 15 Lunar Rover on the Moon video. ● Sketch a diagram of your Lunar Buggy with a close-up view of your wheel and axle design. ● Construct your Lunar Buggy using the available materials. ● Create a ramp which you will use to roll your buggy and experiment with various slopes to give the best distance travelled. ● Test the effectiveness of your buggy by recording the distance it travels from the ramp.
Resources/Materials	• Google Classroom • Assorted construction materials	
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Modifications		
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● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the Lunar Buggy.

S.T.E.M. 7
Unit 4: Design a Landing Pod
Time Allotted (days of instruction): 6

New Jersey Student Learning Standards (NJSLS)
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
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Essential Questions	**Student Learning Objectives**	**Activities**
● What is the most difficult constraint to satisfy in the construction of your landing Pod? ● Which design works best to protect the Lunar Buggy? ● Which materials work best to protect the Lunar Buggy? ● What could you have done differently to make your Landing Pod work better?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Design and build a Landing Pod for the model Lunar Buggy that was built in the previous unit that meets specific size and mass constraints. ● Designate design, assembly, and testing responsibilities to different individuals.	● Sketch a design and develop a list of materials for a Lunar Landing Pod. ● Construct your Landing Pod using the available materials according to given requirements. ● Test your Landing Pod by dropping it from a height given by the teacher and landing right-side up without any parts of it being damaged. ● Reflect upon the success of your Landing Pod and present design adjustments.
Resources/Materials	• Google Classroom • Assorted construction materials	

Interdisciplinary Connections	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. 6.3 Active Citizenship in the 21st Century- All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world. 8.1 Computer and Information Literacy- All students will use computer applications to gather and organize information and to solve problems. 8.2 Technology Education- All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.
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● Teacher observation ● Think/Pair/Share	● Verbal Assessment ● Progress reports	● Project presentation	● Research paper

Modifications		
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● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the

S.T.E.M. 7		
Unit 5: Build a Satellite to Orbit the Moon		
Time Allotted (days of instruction): 6		
New Jersey Student Learning Standards (NJSLS)		
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.		
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.		
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.		
(TO ADD MORE ROWS, RIGHT CLICK AND CHOOSE INSERT ROW BELOW)		
Essential Questions	**Student Learning Objectives**	**Activities**

● What are two things you learned about what engineers do through building your satellite? ● What was the greatest difficulty your team had while trying to complete the satellite challenge? ● How did your team solve this problem? ● What could you have done differently to make your solar oven work better?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Design and build a satellite that meets specific size and mass constraints. ● Designate design, assembly, and testing responsibilities to different individuals. ● Work together to ensure instruments are the right mass, fit correctly, and make proper measurements.	● Sketch a design and develop a list of materials for a Moon orbiting satellite. ● Construct your satellite using the available materials according to given requirements. ● Test your satellite by dropping it from a height of 1 meter without any parts falling off of it. ● Reflect upon the success of your satellite and present design adjustments.
Resources/Materials	• Google Classroom • Assorted construction materials	
Interdisciplinary Connections	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. 6.3 Active Citizenship in the 21st Century- All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world. 8.1 Computer and Information Literacy- All students will use computer applications to gather and organize information and to solve problems. 8.2 Technology Education- All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.	

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Assessments			
Formative	**Summative**	**Benchmarks**	**Alternative**
● Teacher observation ● Think/Pair/Share	● Verbal Assessment ● Progress reports	● Project presentation	● Research paper

Modifications		
English Language Learners	**Special Education/504**	**Gifted and Talented**
● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the satellite.

S.T.E.M. 7
Unit 6: Egg Drop
Time Allotted (days of instruction): 9

New Jersey Student Learning Standards (NJSLS)
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
(TO ADD MORE ROWS, RIGHT CLICK AND CHOOSE INSERT ROW BELOW)

Essential Questions	**Student Learning Objectives**	**Activities**
● What strategies will be employed to protect the egg during the fall? ● Is there a scientific explanation for why the design will protect the egg during the fall? ● How do you calculate the average velocity of the egg? ● How are science and engineering skills used to solve bridge design problems?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Brainstorm and design a device that will protect an egg during a fall from a known distance. ● Explain the components of your egg harness and how they will protect the egg during the fall.	● Sketch a design and develop a list of materials for a prospective egg drop device to be approved by the teacher. ● Construct a harness to protect the egg during its fall once the design has been approved. ● Test your harness without the egg. ● Drop egg in harness and test successfulness of design. ● Reflect upon the success of your device and present design adjustments.
Resources/Materials	• Google Classroom • Assorted construction materials	

Interdisciplinary Connections	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. MP.2 Reason abstractly and quantitatively. 6.3 Active Citizenship in the 21st Century- All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world. 8.1 Computer and Information Literacy- All students will use computer applications to gather and organize information and to solve problems. 8.2 Technology Education- All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.
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Assessments			
Formative	**Summative**	**Benchmarks**	**Alternative**
● Teacher observation ● Think/Pair/Share	● Verbal Assessment ● Progress reports	● Project presentation	● Research paper

Modifications

English Language Learners	Special Education/504	Gifted and Talented
● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the harness.

S.T.E.M. 7		
Unit 7: Popsicle Stick Bridge		
Time Allotted (days of instruction): 9		
New Jersey Student Learning Standards (NJSLS)		
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.		
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.		
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.		
(TO ADD MORE ROWS, RIGHT CLICK AND CHOOSE INSERT ROW BELOW)		
Essential Questions	**Student Learning Objectives**	**Activities**

● Which geometric shapes are most often used in bridge design and why? ● How are science and engineering skills used to solve bridge design problems?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Brainstorm and design a bridge from popsicle sticks. ● Explain the functions of bridge components.	● Watch the footage of the Tacoma Narrows bridge. ● Research famous bridges and their design features. ● Incorporate the designs of successful bridges to design a unique bridge according to given requirements. ● Sketch the design to scale using graph paper. ● Construct the bridge using only popsicle sticks, Elmer's glue and wax paper. ● Test the bridge strength by its ability to support weight. ● Present bridge to class by identifying geometric design features.
Resources/Materials	• Google Classroom • Assorted construction materials	

Interdisciplinary Connections	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. 6.3 Active Citizenship in the 21st Century- All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world. 8.1 Computer and Information Literacy- All students will use computer applications to gather and organize information and to solve problems. 8.2 Technology Education- All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.
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Assessments			
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● Teacher observation ● Think/Pair/Share	● Verbal Assessment ● Progress reports	● Project presentation	● Research paper

Modifications		
English Language Learners	**Special Education/504**	**Gifted and Talented**

● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the bridge.

S.T.E.M. 7		
Unit 8: Build a Solar Oven		
Time Allotted (days of instruction): 9		
New Jersey Student Learning Standards (NJSLS)		
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.		
MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.		
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.		
(TO ADD MORE ROWS, RIGHT CLICK AND CHOOSE INSERT ROW BELOW)		
Essential Questions	**Student Learning Objectives**	**Activities**

● How did the distance from the bottom reflective surface affect the cooking of the food in your oven? ● Is there a difference in the effectiveness of your oven using actual sunlight compared to light from a lamp? ● What could you have done differently to make your solar oven work better?	● Demonstrate an understanding of the Engineering Design Process by utilizing each stage to successfully complete a team challenge. ● Design a solar oven that will effectively cook food. ● Exercise appropriate safety precautions when using your oven and handling the food being cooked in your oven. ● Explain why your design worked well or did not work well.	● Watch the video "Living on the Moon". ● Research solar oven designs and their key features. ● Construct your lunar oven using the available materials according to given requirements. ● Test the effectiveness of your oven by timing how long it takes to cook food.
Resources/Materials	• Google Classroom • Assorted construction materials	
Interdisciplinary Connections	RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. MP.2 Reason abstractly and quantitatively. 6.3 Active Citizenship in the 21st Century- All students will acquire the skills needed to be active, informed citizens who value diversity and promote cultural understanding by working collaboratively to address the challenges that are inherent in living in an interconnected world. 8.1 Computer and Information Literacy- All students will use computer applications to gather and organize information and to solve problems. 8.2 Technology Education- All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual, society, and the environment.	

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● Google Translate ● Dictionary ● Use of diagrams ● Make lessons visual	● Preferential seating ● Instructional Groups ● Modeling/Demonstration ● Refocus attention	● Limit the number of students in each group to 3. ● Limit the number of construction days. ● Limit the types of materials used to construct the oven.

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