

CURRICULUM

**FOR
STEM**

GRADE 8

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

ACKNOWLEDGMENTS

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Subject/Course Title:
STEM
Grade 8

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RAHWAY PUBLIC SCHOOLS CURRICULUM

STEM: Grade 8

PACING GUIDE

Unit	Title	Pacing
1	Careers in STEM	3 week
2	Bridge Building	5 weeks

ACCOMMODATIONS

<p>504 Accommodations:</p> <ul style="list-style-type: none"> ● Provide scaffolded vocabulary and vocabulary lists. ● Provide extra visual and verbal cues and prompts. ● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. ● Provide links to audio files and utilize video clips. ● Provide graphic organizers and/or checklists. ● Provide modified rubrics. ● Provide a copy of teaching notes, especially any key terms, in advance. ● Allow additional time to complete assignments and/or assessments. ● Provide shorter writing assignments. ● Provide sentence starters. ● Utilize small group instruction. ● Utilize Think-Pair-Share structure. ● Check for understanding frequently. ● Have student restate information. ● Support auditory presentations with visuals. ● Weekly home-school communication tools (notebook, daily log, phone calls or email messages). ● Provide study sheets and teacher outlines prior to assessments. ● Quiet corner or room to calm down and relax when anxious. ● Reduction of distractions. ● Permit answers to be dictated. ● Hands-on activities. ● Use of manipulatives. ● Assign preferential seating. ● No penalty for spelling errors or sloppy handwriting. ● Follow a routine/schedule. ● Provide student with rest breaks. ● Use verbal and visual cues regarding directions and staying on task. ● Assist in maintaining agenda book. 	<p>IEP Accommodations:</p> <ul style="list-style-type: none"> ● Provide scaffolded vocabulary and vocabulary lists. ● Differentiate reading levels of texts (e.g., Newsela). ● Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials. ● Provide extra visual and verbal cues and prompts. ● Provide links to audio files and utilize video clips. ● Provide graphic organizers and/or checklists. ● Provide modified rubrics. ● Provide a copy of teaching notes, especially any key terms, in advance. ● Provide students with additional information to supplement notes. ● Modify questioning techniques and provide a reduced number of questions or items on tests. ● Allow additional time to complete assignments and/or assessments. ● Provide shorter writing assignments. ● Provide sentence starters. ● Utilize small group instruction. ● Utilize Think-Pair-Share structure. ● Check for understanding frequently. ● Have student restate information. ● Support auditory presentations with visuals. ● Provide study sheets and teacher outlines prior to assessments. ● Use of manipulatives. ● Have students work with partners or in groups for reading, presentations, assignments, and analyses. ● Assign appropriate roles in collaborative work. ● Assign preferential seating. ● Follow a routine/schedule.
<p>Gifted and Talented Accommodations:</p> <ul style="list-style-type: none"> ● Differentiate reading levels of texts (e.g., Newsela). ● Offer students additional texts with higher lexile levels. ● Provide more challenging and/or more supplemental readings and/or activities to deepen understanding. ● Allow for independent reading, research, and projects. ● Accelerate or compact the curriculum. ● Offer higher-level thinking questions for deeper analysis. ● Offer more rigorous materials/tasks/prompts. ● Increase number and complexity of sources. ● Assign group research and presentations to teach the class. ● Assign/allow for leadership roles during collaborative work and in other learning activities. 	<p>ML Accommodations:</p> <ul style="list-style-type: none"> ● Provide extended time. ● Assign preferential seating. ● Assign peer buddy who the student can work with. ● Check for understanding frequently. ● Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc...). ● Have student repeat directions. ● Make vocabulary words available during classwork and exams. ● Use study guides/checklists to organize information. ● Repeat directions. ● Increase one-on-one conferencing. ● Allow student to listen to an audio version of the text. ● Give directions in small, distinct steps. ● Allow copying from paper/book. ● Give student a copy of the class notes.

- Provide written and oral instructions.
- Differentiate reading levels of texts (e.g., Newsela).
- Shorten assignments.
- Read directions aloud to student.
- Give oral clues or prompts.
- Record or type assignments.
- Adapt worksheets/packets.
- Create alternate assignments.
- Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted.
- Allow student to resubmit assignments.
- Use small group instruction.
- Simplify language.
- Provide scaffolded vocabulary and vocabulary lists.
- Demonstrate concepts possibly through the use of visuals.
- Use manipulatives.
- Emphasize critical information by highlighting it for the student.
- Use graphic organizers.
- Pre-teach or pre-view vocabulary.
- Provide student with a list of prompts or sentence starters that they can use when completing a written assignment.
- Provide audio versions of the textbooks.
- Highlight textbooks/study guides.
- Use supplementary materials.
- Give assistance in note taking
- Use adapted/modified textbooks.
- Allow use of computer/word processor.
- Allow student to answer orally, give extended time (time-and-a-half).
- Allow tests to be given in a separate location (with the ESL teacher).
- Allow additional time to complete assignments and/or assessments.
- Read question to student to clarify.
- Provide a definition or synonym for words on a test that do not impact the validity of the exam.
- Modify the format of assessments.
- Shorten test length or require only selected test items.
- Create alternative assessments.
- On an exam other than a spelling test, don't take points off for spelling errors.

UNIT OVERVIEW

Content Area: STEM

Unit Title: Careers in STEM

Target Course/Grade Level: 8

Unit Summary:

Exploring STEM careers allows students to gain insights into the diverse opportunities and applications of Science, Technology, Engineering, and Mathematics. This exploration aims to spark interest, inspire passion, and help students make informed decisions about their academic and career paths. Students will gain a comprehensive understanding of STEM careers, empowering them to make informed decisions about their educational and career pathways in the future.

Approximate Length of Unit: 3 Weeks

LEARNING TARGETS

NJ Student Learning Standards:

Engineering Design:

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.

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Career Readiness, Life Literacies, and Life Skills

9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest.

9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.

9.3.ST-ET.5: Apply the knowledge learned in STEM to solve problems.

9.3.ST-SM.2: Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

9.3.ST-SM.3: Analyze the impact that science and mathematics has on society.

9.4.7.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.

9.4.7.CI.4: Research the development process of a product and identify the role of failure as a part of the creative process.

Interdisciplinary Connections and Standards:

Literacy:

L.7.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.

SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

W.7.1 Write arguments to support claims with clear reasons and relevant evidence.

Technology:

8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.

Social Studies, Science, and Technical Subjects ELA Companion Standards

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Unit Understandings:

Students will understand that...

- Students will recognize that careers in STEM encompass a wide range of fields and opportunities, including but not limited to science, technology, engineering, mathematics, healthcare, environmental science, and computer science.
- Students will understand that STEM professionals use critical thinking, creativity, and scientific methods to solve complex problems and make informed decisions.
- Students will grasp that STEM concepts and skills have practical applications in solving real-world challenges and improving everyday life.
- Students will appreciate the importance of continuous learning and skill development in pursuing and succeeding in STEM careers due to the rapid advancements in technology and scientific knowledge.
- Students will understand that effective collaboration and teamwork are essential for success in STEM careers, as many projects require multiple perspectives and skills.

Unit Essential Questions:

- What is the engineering design process, and how does it work?
- How does collaboration enhance the quality of engineering solutions?
- Why is it important to iterate and improve designs during the engineering process?
- How can we apply the engineering design process to address real-world problems?

Knowledge and Skills:

Students will be able to...

- Utilize presentation software of their choice to create a presentation to share information about different careers in STEM fields and what is required for that career
- Become an “expert” in a STEM career of their choice
- Explain how STEM careers can have a profound impact on society
- Explain how there are ethical implications in STEM fields and the importance of making responsible and sustainable decisions

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

- [STEM Career Interest Inventory](#)

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

Conduct career interest inventories and self-assessment exercises to help students discover their natural aptitudes and interests related to STEM fields. These assessments can be in the form of questionnaires or interactive activities that explore their preferences, values, and skills. By reflecting on their strengths and interests, students can identify potential STEM careers that align with their passions and talents.

Students will research different types of careers in the STEM field and create a presentation that they will present to the class. Students will become experts about the selected STEM career including educational requirements for the career, what the career entails, what type of salary, etc. Students will create a presentation to share with their peers related to the STEM career they researched.

RESOURCES

Teacher Resources:

- [STEM Career Interest Inventory](#)
- [TeachEngineering.org: Stream Consciousness](#)

Equipment Needed:

- Chromebooks
- Projector with Computer
- Dry Erase Markers
- Project materials for prototype
- Notebooks
- Pencils and Erasers
- Ruler
- Scissors
- Tape or Glue

UNIT OVERVIEW

Content Area: STEM

Unit Title: Bridge Building

Target Course/Grade Level: 8

Unit Summary:

Students will develop a comprehensive understanding of bridge engineering principles, problem-solving skills, collaboration, and creativity. They will also gain valuable insights into the importance of engineering in building structures that impact society's infrastructure and sustainability.

Students will design and build a bridge. They will learn about the history of bridges and the many different types of bridges. Students will use basic engineering principles and design methods in designing and constructing their bridge.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:

Engineering Design

- 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.
- MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Career Readiness, Life Literacies, and Key Skills:

- 9.4.8.CT.1:** Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective.
- 9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option.
- 9.4.8.CT.3:** Compare past problem-solving solutions to local, national or global issues and analyze the factors that led to a positive or negative outcome.

Interdisciplinary Connections and Standards:

Literacy:

- L.7.3** Use knowledge of language and its conventions when writing, speaking, reading, or listening.

SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.

W.7.1 Write arguments to support claims with clear reasons and relevant evidence.

Unit Understandings:

Students will understand that...

- Bridges are one of the earliest technologies that served to make the world easier to navigate.
- Bridges have made it possible for people to quickly go to places that they previously would have to travel longer distances by land to get to.

Unit Essential Questions:

- How have bridges affected society throughout time?
- What types of bridges are there?
- Why are there so many different types of bridges?
- How are bridges designed, made, and tested?
- How do bridges work?

Knowledge and Skills:

Students will be able to...

- Students will be able to differentiate between various types of bridges, such as arch, beam, suspension, and truss bridges.
- Students will identify and describe the key structural components of bridges, including abutments, piers, girders, and cables.
- Students will comprehend the fundamental engineering principles involved in designing stable and strong bridges.
- Students will explain how forces, such as compression, tension, and torsion, affect bridge stability and load-bearing capacity.
- Students will conduct research to investigate Famous Bridge Designs
- Students will research and present information about iconic bridges worldwide, including their historical significance and engineering innovations.
- Students will explore how famous bridges have influenced modern bridge design and construction
- Students will recognize the importance of safety considerations in bridge design and construction.
- Students will explore sustainable practices in bridge engineering to minimize environmental impact and increase longevity.
- Students will participate in engineering challenges that require them to design and construct bridges to meet specific criteria and constraints.
- Students will iterate on their designs based on feedback and evaluations, fostering a growth mindset in problem-solving.
- Students will present their model bridges to the class, explaining their design choices and the lessons learned during the construction process.
- Students will reflect on the challenges, successes, and improvements made in their bridge-building journey.
- Explain why certain types of bridges are better than others and the situations that require specific types of bridges

- Design a bridge based on bridge engineering and design concepts
- Create a model of the type of bridge
- Identify a technological problem and use the Engineering Design process to create an appropriate solution.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly “understand”?

Pre-Lesson Assessment

Brainstorming: As a class, have students engage in open discussion. Remind them that in brainstorming, no idea or suggestion is "silly." All ideas should be respectfully heard. Take an uncritical position, encourage wild ideas and discourage criticism of ideas. Have students raise their hands to respond. Write their ideas on the board.

Ask the students:

What are the different ways that a bridge or building is connected to the ground?

Post-Introduction Assessment

Voting: Ask a true/false question and have students vote by holding thumbs up for true and thumbs down for false. Tally the votes and write the totals on the board. Give the right answer.

- True or False: Usually, a poor foundation can be easily fixed. (Answer: False. A poor foundation is often irreparable.)
- True or False: Sometimes, foundations must go deeper into the ground than a structure is tall. (Answer: True)

Lesson Summary Assessment

Flashcards: Each student on a team creates a flashcard with a question on one side and the answer on the other. If the team cannot agree on the answers, they should consult the teacher. Pass the flashcards to the next team. Each member of the team reads a flashcard, and everyone attempts to answer it. If they are right, they can pass on the card to the next team. If they feel they have another correct answer, they should write their answer on the back of the flashcard as an alternative. Once all teams have done all the flashcards, clarify any questions.

Sample questions and answers:

- Q: What are methods for soil investigations? (Answer: Gather, examine and describe soil samples, determine water table levels, notice any environmental concerns, take borehole samples, dig trenches, develop a soil profile.)
- Q: What are two types of foundations? What are the differences? (Answer: Shallow foundations do not extend very far into the ground. Deep foundations extend deep into the ground.)
- Q: What are foundations made from? (Answer: Usually wood, concrete or steel.)
- Q: What are types of shallow foundations? Types of deep foundations? (Answer: Shallow foundations may be spread footing foundations [or footers or footing] and mat foundations. Deep foundations may be caissons, drilled shafts and piles.)
- Q: Why is it important to investigate soil conditions before designing a bridge or structure? (Answer: So it is designed and built to perform reliably in those conditions.)

- Q: Why are foundations so important? (Answer: Foundations connect a structure or bridge to the ground and support the load of the bridge or structure, so it does not move or fall.)
- Q: What is bearing pressure? Why do engineers need to consider it when they design a structure? (Answer: Bearing pressure is the weight or force bearing down on the soil from the bottom of the foundation. Engineers must make sure the soil can support the load that will be placed on it.)
- Q: What is settlement? Are there different types? Why is it important? (Answer: Settlement is the vertical downward movement of the foundation. Engineers make settlement calculations as part of their foundation design, to prevent settlement of the structure from occurring.)

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Students will use mathematical calculations to determine bridge dimensions, angles, and load capacities.
- Students will plan and design model bridges, considering factors like span length, materials, and load distribution.
- Students will use various materials (e.g., popsicle sticks, straws, or toothpicks) to construct their model bridges, applying engineering concepts learned.
- Students will conduct load tests on their model bridges to assess their strength and stability.
- Students will analyze and document their test results, identifying areas for improvement in their bridge designs.
- Students will work collaboratively in teams to brainstorm, plan, and construct their model bridges.
- Students will effectively communicate and delegate tasks within their groups to achieve successful project outcomes.
- Students will conduct research to investigate Famous Bridge Designs
- Students will research and present information about iconic bridges worldwide, including their historical significance and engineering innovations.
- Students will present their model bridges to the class, explaining their design choices and the lessons learned during the construction process.
- Students will reflect on the challenges, successes, and improvements made in their bridge-building journey.

RESOURCES

Teacher Resources:

Bridge resources:

- <http://www.pbs.org/wgbh/buildingbig/bridge/basics.html>
- <https://www.bridgeweb.com/>

Equipment Needed:

- Chromebooks
- Projector with Computer
- Dry Erase Markers

- Notebooks
- Pencils and Erasers