Girard School District

Curriculum Map and Pacing Guide

Content Area:	**STEM Innovation Lab**	**Teacher(s):**	Tobolewski
Grade Level:	8	**Unit Duration:**	5 days
Unit Title:	**UNIT 1: Think Like a Scientist & Engineer**		
Unit Overview:	Students are introduced to scienctific phenomena. Students make observations and create theories/mental models explaining the phenomena.		
		Board Approval Date:	**August 2026**

Content

Science Phenomena:	***Driving Phenomenon:*** "How can our observations help us to understand what we see?"	**Essential Question(s):**	How do scientists make sense of the natural world? What makes an observation different from an inference? How do scientists develop explanations for phenomena? Why do scientific explanations change over time? How does evidence support or challenge a theory?

	Life	Physical	Earth & Space	Environmental Literacy & Sustainability	Technology & Engineering
Standards:	N/A	3.2.6-8: PS2: Motion and Stability-Forces and Interactions; PS3: Energy	ESS3: Earth and Human Activity	**Environmental Problem Solving**	3.5.6-8.A; 3.5.6-8.B; 3.5.6-8.C;

Crosscutting Concepts (CCCs)

Cause & Effect:	Events have causes, sometimes simple and sometimes multifaceted. Understanding cause-and-effect relationships helps predict and explain phenomena. Students analyze how design choices influence performance and outcomes during engineering challenges and investigations.
Systems and System Models:	A system is a group of interacting components that work together to perform a function. Students examine structures, airplanes, and prototypes as systems composed of interacting parts working together to achieve a function.
Stability & Change:	Systems can be stable over time or change when conditions are altered. Students test designs, identify weaknesses, and make modifications to improve stability and effectiveness.
Structure & Function:	The way an object is shaped or structured determines how it functions. Students investigate how the shape, organization, and construction of a design influences its ability to perform a task.

Scientific & Engineering Practices (SEPs)

Investigating Practices	Sensemaking Practices	Critiquing Practices
Asking questions & defining problems	Developing & using models	Engaging in argument from evidence
Planning & carrying out investigations	Analyzing & interpreting data	Obtaining, evaluating, & communicating information
	Constructing explanations & designing solutions	

Vocabulary

Content/Domain Specific					Academic			
engineer	scientist	prototype	design process	criteria	analyze	evaluate	justify	infer
constraints	innovation	model	data	evidence	investigate	revise	optimize	collaborate
investigation	observation	optimization	variable		communicate	synthesize	construct	

Curriculum Resources & Materials

STEM notebooks	Demonstration materials	Chromebooks

Girard School District

Curriculum Map and Pacing Guide

Pacing Guide							
Day	**Key Concept/Learning Target**	**Engage**	**Explore**	**Explain**	**Elaborate**	**Evaluate**	**Assessment/Check for Understanding**
1	**Observations and Theories** *I can make observations about a scientific phenomena and develop a theory.*	**Elephant Toothpaste Demonstration** ***Question:*** *What did you observe?*	**Students learn the difference between observations and theories.** Demonstration is repeated.	**Students record their observations.**	**Students create a theory as to what is causing the phenomena.**	**Exit ticket:** *Define observations and scientific theory in their own words.*	**Formative Assessments:** exit tickets, STEM notebook entries, design sketches, data tables, group discussions, CER responses;
2	**Observations and Theories** *I can make observations about a scientific phenomena and develop a theory.*	**Molecular Motion demonstrations.** ***Question:*** *What explains your observations?*	**Second molecular motion demonstration.** *Students make observations.*	**Students write a scientific theory.** *Individually, small groups.*	Students share their theories in large group and offer feedback to others.	**Reflection:** A theory is only as good as its explanatory power.	
3	**Observations and Theories** *I can make observations about a scientific phenomena and develop a theory.*	**Phenomenon:** Gas Law demonstrations. **Question:** *What did you observe?*	*Students make observations.*	**Students write a scientific theory.** *Individually, small groups.*	Students share their theories in large group and offer feedback to others.	**Exit Ticket**: where in real life phenomena can this new theory of yours be applied?	**Summative Assessments "Engineering Design Challenge Portfolio":** problem definition, design sketches, testing results, data analysis, reflection, revised design
4	**Observations and Theories** *I can make observations about a scientific phenomena and develop a theory.*	**Phenomenon:** Gummy Bear Demonstration **Question:** *What did you observe?*	*Students make observations.*	**Students write a scientific theory.** *Individually, small groups.*	Students share their theories in large group and offer feedback to others.	**Exit ticket:** What conclusions can you draw about a fundalmental law of matter?	
5	**Observations and Theories** *I can make observations about a scientific phenomena and develop a theory.*	**Phenomenon:** Perpetual water fountian **Question:** *What did you observe?*	*Students make observations.*	**Students write a scientific theory.** *Individually, small groups.*	Students share their theories in large group and offer feedback to others.	**Exit ticket:** What conclusions can you draw about a fundalmental law of matter?	

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Curriculum Map and Pacing Guide

Content Area:	**STEM Innovation Lab**	**Teacher(s):**	Tobolewski
Grade Level:	8	**Unit Duration:**	3 days
Unit Title:	**UNIT 2: Think Like an Engineer**		
Unit Overview:	Students are introduced to engineering challenge and must collaborate to complete the challenge.		
		Board Approval Date:	**August 2026**

Content

Science Phenomena:	***Driving Phenomenon:*** "How are engineers able to solve complex problems that have never been solved before?"	**Essential Question(s):**	How do engineers solve problems? Why are criteria and constraints important? Why do engineers rarely get a perfect solution on the first attempt? How does collaboration improve engineering solutions?

Standards:	**Life**	**Physical**	**Earth & Space**	**Environmental Literacy & Sustainability**	**Technology & Engineering**
	N/A	3.2.6-8: PS2: Motion and Stability-Forces and Interactions; PS3: Energy	ESS3: Earth and Human Activity	**Environmental Problem Solving**	3.5.6-8.A; 3.5.6-8.B; 3.5.6-8.C;

Crosscutting Concepts (CCCs)

Cause & Effect:	Events have causes, sometimes simple and sometimes multifaceted. Understanding cause-and-effect relationships helps predict and explain phenomena. Students analyze how design choices influence performance and outcomes during engineering challenges and investigations.
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Scientific & Engineering Practices (SEPs)

Investigating Practices	**Sensemaking Practices**	**Critiquing Practices**
Asking questions & defining problems	Developing & using models	Engaging in argument from evidence
Planning & carrying out investigations	Analyzing & interpreting data	Obtaining, evaluating, & communicating information
	Constructing explanations & designing solutions	

Vocabulary

Content/Domain Specific					**Academic**			
engineer	scientist	prototype	design process	criteria	analyze	evaluate	justify	infer
constraints	innovation	model	data	evidence	investigate	revise	optimize	collaborate
investigation	observation	optimization	variable		communicate	synthesize	construct	

Curriculum Resources & Materials

STEM notebooks	Mini Marshmallows	Eye masks	Chromebooks
Demontration Materials	Dry Spagehtti	Bike tubes, string, meter sticks, metal cans	
Dry popcorn	LEGO Kits		

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Curriculum Map and Pacing Guide

Pacing Guide

Day	Key Concept/Learning Target	Engage	Explore	Explain	Elaborate	Evaluate	Assessment/Check for Understanding
1	**Engineering and Design** *Identify the criteria and constraints of an engineering challenge.* *Design and construct a prototype.* *Test and improve a design based on results.* *Reflect on how redesign improves engineering solutions.*	**Task requirements are given** *Design and build the tallest free-standing tower using only dry spaghetti and mini marshmallows.*	**Working in teams, students brainstorm ideas, sketch designs, and construct their towers within the allotted time.** After testing, teams analyze failures and strengths before completing a second design iteration.	**Students discuss:** What design choices worked well? Why did some towers fail? How did redesign improve performance?	**Students compare their design process to how professional engineers develop bridges, skyscrapers, and other structures through repeated testing and redesign.**	**Exit ticket:** *Define observationsStudents complete a design reflection describing:* *Their original design* *Changes made during redesign* *Evidence that redesign improved the structure* *Lessons learned about engineering*	**Formative Assessments:** exit tickets, STEM notebook entries, design sketches, data tables, group discussions
2	**Collaboration and Communication** *I can communicate techinical information clearly.*	**Display a completed LEGO model.** *Could someone build this accurately without ever seeing it?*	**One student wears a blindfold while teammates provide only verbal instructions to guide construction of a LEGO model.** *After the first attempt, teams discuss communication challenges before completing a second round using improved communication strategies.*	**Group Discussion** *Which communication strategies were effective?*	Students compare the communication required during the activity to real engineering fields where mistakes in communication can have significant consequences..	**Reflection:** Students complete a teamwork reflection describing: Effective communication strategies Obstacles encountered How teamwork improved performance One strategy they would use in future collaborative projects.	
3	**Engineering and Communication** *I can understand that engineers solve complex problems by working collaboratively, evaluating constraints, and developing innovative solutions.*	**Phenomenon:** Toxic Popcorn **Question:** *Can you work with a group to solve a complex engineering problem.*	***Toxic Popcorn Challengen*** A container of toxic material has spilled in a hazardous area. Engineers must safely transfer the material to a secure container without entering the contaminated zone.	**Student discussion** *Which design was most effective? Which restraint was the most difficult.*	Students brainstorm other situations where engineers solve problems remotely, such as space exploration, underwater research, nuclear facilities, and medical robotics.	Students complete a reflection identifying: Their team's solution Challenges encountered Modifications made One improvement they would make in a future design?	**Summative Assessments "Engineering Design Challenge Completion"**

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Curriculum Map and Pacing Guide

Content Area:	**STEM Innovation Lab**	**Teacher(s):**	Tobolewski
Grade Level:	8	**Unit Duration:**	9-10 days (6 lessons)
Unit Title:	**UNIT 3: Observation and Application**		
Unit Overview:	Students are introduced to scienctific phenomena, make observations, and apply that information to a variety of new novel tasks.		
		Board Approval Date:	**August 2026**

Content

Science Phenomena:	***Driving Phenomenon:*** "How can invisible properties of matter explain the world around us?"	**Essential Question(s):**	How do scientists use measurements to explain natural phenomena? Why do some objects float while others sink? How do differences in density affect everyday materials? How does water influence Earth's climate? How can scientific concepts explain weather patterns in our region?

Standards:	**Life**	**Physical**	**Earth & Space**	**Environmental Literacy & Sustainability**	**Technology & Engineering**
	N/A	3.2.6-8: PS2: Motion and Stability-Forces and Interactions; PS3: Energy	ESS3: Earth and Human Activity;	**Environmental Problem Solving**	3.5.6-8.A; 3.5.6-8.B; 3.5.6-8.C;

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Scientific & Engineering Practices (SEPs)

Investigating Practices	Sensemaking Practices	Critiquing Practices
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Planning & carrying out investigations	Analyzing & interpreting data	Obtaining, evaluating, & communicating information
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Vocabulary

Content/Domain Specific					Academic			
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Curriculum Resources & Materials

STEM notebooks	Film canisters	Fruit Drinks	Vernier Temperature Probes
Demontration Materials	water	Chromebooks	

Girard School District

Curriculum Map and Pacing Guide

Pacing Guide							
Day	**Key Concept/Learning Target**	**Engage**	**Explore**	**Explain**	**Elaborate**	**Evaluate**	**Assessment/Check for Understanding**
1	**Density and Buoyancy** *I can understand that density is a measurable property of matter that determines whether an object will float or sink in a fluid.*	**Demonstrate several objects floating and sinking in water, including surprising examples** *Ask students why objects behave differently and record initial ideas.*	**Students are given balances, rulers, graduated cylinders, etc.** Students develop and mathematical theory about why objects sink and float in water.	**Introduce the density equation and compare object density to water.**	**Students predict whether unfamiliar objects will float or sink using density calculations and explain their reasoning.**	Students calculate density for new objects and use evidence to explain why each object floats or sinks.	**Formative Assessments:** exit tickets, STEM notebook entries, design sketches, data tables, group discussions
2	**Fruit Drink Denisty Investigation** *I can understand that liquids have different densities that can be determined through careful experimentation.*	**Introduce the challenge. Create a density column of layered fruit juices based on density.** *Can you make a layered drink?*	**Students start to evaluate the different fruit drinks?** *Figure out the relative order of densities.*	**Students compare** *Students compare their findings*	Students make one final density column	**Reflection:** Students evaluate their experimentation process and how it could have been improved	
3	**Engineering a Galileo Thermometer** *I can apply density to and engineering task*	**Phenomenon:** Galileo Thermometer **Show the students a Galileo thermometer.**	***Introduce the challenge*** Using sand and film canisters create a Galileo Thermometer at different Temperatures	**Develop a theory** *Students collaborate to develop a theory to explain their data*	Students are introduced formally to the concept of specific heat capacity	**Reflection:** Student explain specific heat capacity in their own words.	
4	**Specific Heat Capacity** *I can understand that different substances absorb and release thermal energy at different rates because they have different specific heat capacities.k*	**Phenomenon:** Sand and Water absorb energy differently **Show students sand and water under a identical heat source. Have them collect data to prove there is a difference between properties of the two substances.**	***Student design experimental parameters***	**Student collaboration** *Students work in groups to optimize thier design.*	Students compare their design with commercial Galileo thermometers and identify improvements.	Students complete a reflection identifying: Challenges encountered Modifications made One improvement they would make in a future design?	**Summative Assessments:** 1. Galileo Thermometer Challgenge. 2. Create a presentation explaining Lake Effect Snow in terms of Specific Heat Capacity
5	**Lake Erie Temperature Investigation** *I can interpret graphs and data*	**Phenomenon:** Yearly average air and water temperature data for Lake Erie **Students intepret the data.**	***Studens develop a theory to explain their data*** What causes the air and water temperature trends to be different?	**Group discussion** *Students compare their theories in large group and develop one class theory.*	Students explain how these findings may effect our daily lives.	**Reflection:** What are the implications of your findings for our daily lives?	
6	**Lake Effect Snow Explanation** *I can explain why Girard gets so much Lake Effect Snow*	**Phenomenon:** Lake Effect Snow **Show the students snow accumulation data for Erie, PA**	***Introduce the assignment*** Explain why we get so much snow here in terms of specific heat capacity.	**Research** *Students research to enhance their knowledge.*	Students develop an explanation to the essential question.	Students present their data given theories in a video presentation	

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Curriculum Map and Pacing Guide

Content Area:	**STEM Innovation Lab**	**Teacher(s):**	Tobolewski
Grade Level:	8	**Unit Duration:**	12 days (4 Lessons)
Unit Title:	**UNIT 4: Alternative Energy and Innovation**		
Unit Overview:	Students are introduced to scienctific phenomena, make observations, and apply that information to a variety of new novel tasks.		
		Board Approval Date:	**August 2026**

Content

Science Phenomena:	***Driving Phenomenon:*** "What alternative energies can enhance our society?"	**Essential Question(s):**	How can engineers use science and technology to meet our future energy needs? What are the advantages and limitations of different alternative energy sources? How do engineers evaluate and improve renewable energy technologies to solve real-world problems?

	Life	Physical	Earth & Space	Environmental Literacy & Sustainability	Technology & Engineering
Standards:	N/A	3.2.6-8: PS2: Motion and Stability-Forces and Interactions; PS3: Energy	ESS3: Earth and Human Activity	**Environmental Problem Solving**	3.5.6-8.A; 3.5.6-8.B; 3.5.6-8.C;

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Scientific & Engineering Practices (SEPs)

Investigating Practices	Sensemaking Practices	Critiquing Practices
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Curriculum Resources & Materials

STEM notebooks	Teabag	Wooden Spoons	Chromebooks
Kidwind turbines	Scissors, Rulers, Pencils	Cardboard, paper, napkins, rubber bands	Hair dryer

Girard School District

Curriculum Map and Pacing Guide

Pacing Guide							
Day	**Key Concept/Learning Target**	**Engage**	**Explore**	**Explain**	**Elaborate**	**Evaluate**	**Assessment/Check for Understanding**
1-2	**Engineering and Design** *Identify the criteria and constraints of an engineering challenge.* *Design and construct a prototype.* *Test and improve a design based on results.*	*Engineer a device to lift a teabag vertically 12" using a blowdryer and asoorted supplies*	**Working in teams, students brainstorm ideas, sketch designs, and construct their devices within the allotted time.** After testing, teams analyze failures and strengths before completing a second design iteration.	**Students discuss:** What design choices worked well? Why did some towers fail? How did redesign improve performance?	**Students compare their design process to how professional engineers develop alternative energy solutions**	Exit ticket: Define observationsStudents complete a design reflection describing: Their original design Changes made during redesign Evidence that redesign improved the structure Lessons learned about engineering	**Formative Assessments:** exit tickets, STEM notebook entries, design sketches, data tables, group discussions
3-5	**Engineering and Design** *Identify the criteria and constraints of an engineering challenge.* *Design and construct a prototype.* *Test and improve a design based on results.* *Reflect on how redesign improves engineering solutions.*	**Introduce Kidwind Turbines** *Engineer blades for a wind turbine to create 1V of electricity*	**Working in teams, students brainstorm ideas, sketch designs, and construct their turbines within the allotted time.** After testing, teams analyze failures and strengths before completing a second design iteration.	**Students discuss:** What design choices worked well? Why did some towers fail? How did redesign improve performance?	**Students compare their design process to how professional engineers develop alternative energy solutions**	Exit ticket: Define observationsStudents complete a design reflection describing: Their original design Changes made during redesign Evidence that redesign improved the structure Lessons learned about engineering	
8-12	**Alternative Energy Research** *I can research a topic to present with correct citations and methods*	**Select a Alternative energy to research** Students given summative assessment options and parameters	**Fill out basic information and create 1st draft**	**What needs to be improved to meet parameters**	**2nd and 3rd drafts of project are created**	**Reflection:** What is the most interesting part of your technology	**Summative Assessments:** 1. Teabage design challenge 2. Turbine Design Challenge. 3. Alternative Energy Research Assignment