STEM Curriculum Planning Guide

This instructional design guide serves as the template for the design and development of STEM units of instruction at the Dayton Regional STEM Center in Dayton, Ohio. The guide is anchored to the *STEM Education Quality Framework* also developed at the Dayton Regional STEM Center.

STEM Unit Title	**Around the Windows: Looking Through Stained Glass**
Economic Cluster	Advance manufacturing and materials Environmental Engineering
Targeted Grades	7
STEM Disciplines	Science Technology Engineering Mathematics
Non-STEM Disciplines	Social studies Language Arts

a. Acknowledgement of Support. Unless otherwise provided in the grant, the grantee is responsible for assuring that an acknowledgment of NSF support is made:

(i) in any publication (including Web pages) of any material based on or developed under this project, in the following terms:

"This material is based upon work supported by the National Science Foundation under Grant No. EEC - 1009607."

(ii) NSF support also must be orally acknowledged during all news media interviews, including popular media such as radio, television and news magazines.

b. Disclaimer. The awardee is responsible for assuring that every publication of material (including World Wide Web pages) based on or developed under this award, except scientific articles or papers appearing in scientific, technical or professional journals, contains the following disclaimer:

"Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation."

c. Copies for NSF. The grantee is responsible for assuring that the cognizant NSF Program Officer is provided access to, either electronically or in paper form, a copy of every publication of material based on or developed under this award, clearly labeled with the award number and other appropriate identifying information, promptly after publication.

Section I: STEM Unit Overview

Unit Overview

Students ware engaged in various inquiries to build an understanding of wavelengths and energy transfer. They also incorporate geometry, problem solving, writing, early civilization influences, and technology skills. Teams of students create a stained glass window jar in order to discover which light wave is most efficient in reducing the effect of the classroom temperature. Teams use the engineering design process to help design and build prototypes of different windows. Students then use their knowledge to write a proposal to their school administration for creating a "stained glass effect" on the school's windows.

Essential Question

How can we design a stained glass window to use for testing ways in which wavelengths of light affect the transfer of thermal energy into a room?

Enduring Understanding

Each color wavelength emits a different amount of energy.

Thermal energy can be transferred by conduction, convection, and radiation.

Temperature is a measurement of kinetic energy.

Engineering Design Challenge

Student teams are challenged to design stained glass two-liter bottle to test ways in which classroom temperature cab be controlled through color and window placement. Teams test the temperature change caused by various wavelengths (color) of light in comparison to a transparent container. Through experimenting and testing, they design a prototype to help control the transfer of thermal energy into their classroom. Throughout the engineering design challenge, students discover which color window is most efficient for controlling thermal energy transfer and maintaining a cooler classroom during warm seasons.

Time and Activity Overview

Day	Time Allotment	Actvities
1	50 minutes	Pretest Introduction- History and Background
2	50 minutes	Code of Cooperation Engineering Design Process
3	50 minutes	Geometry with Tan-Grams
4	50 minutes	Energy and Heat Transfers
5	50 minutes	Design Thermal Energy Transfer with Light and Color
6	50 minutes	Data Collection from Containers and Preliminary Window Design
7	50 minutes	Window Testing and Redesign
8	50 minutes	Presentation Preparation
9	50 minutes	Presentations Post-Test

Pre-requisite Knowledge & Skill	Science Grade 6 (review) Theme: Order and Organization Topic: Matter and Motion Content Standard: There are two categories of energy: kinetic and potential. Objects and substances in motion have kinetic energy. Objects and substances can have energy as a result of their position (potential energy).

Academic Content Standards

Add Standard	Mathematics	Ohio
Grade/Conceptual Category	7	
Domain	Geometry	
Cluster	Draw, construct, and describe geometrical figures and describe the relationships between them.	
Standards	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique	

Add Standard	Mathematics	Ohio
Grade/Conceptual Category	7	
Domain	Geometry	
Cluster	Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	
Standards	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	

Add Standard	Mathematics	Ohio
Grade/Conceptual Category	7	
Domain	Expression and Equations	
Cluster	Use properties of operations to generate equivalent expressions.	
Standards	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	

Add Standard	English Language Arts	Ohio

Add Standard	English Language Arts	Ohio
Grade	6 - 8	
Strand	Reading Standards for Literacy in Science and Technical Subjects 6–12	
Topic	Key Ideas and Details	
Standard	1. Cite specific textual evidence to support analysis of science and technical texts. 2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. 3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	

Add Standard	English Language Arts	Ohio
Grade	6 - 8	
Strand	Reading Standards for Literacy in Science and Technical Subjects 6–12	
Topic	Craft and Structure	
Standard	4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics. 5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic. 6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.	

Add Standard	English Language Arts	Ohio
Grade	6 - 8	
Strand	Reading Standards for Literacy in Science and Technical Subjects 6–12	
Topic	Integration of Knowledge and Ideas	

Add Standard	English Language Arts	Ohio
Standard	5. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). 6. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. 7. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.	

Add Standard	English Language Arts	Ohio
Grade	6 - 8	
Strand	Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects 6–12	
Topic	Texts Types and Purpose	
Standard	1. Write arguments focused on discipline-specific content. a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically. b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources. c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence. d. Establish and maintain a formal style. e. Provide a concluding statement or section that follows from and supports the argument presented. 2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. d. Use precise language and domain-specific vocabulary to inform about or explain the topic. e. Establish and maintain a formal style and objective tone. f. Provide a concluding statement or section that follows from and supports the information or explanation presented.	

Add Standard	English Language Arts	Ohio

Add Standard	English Language Arts	Ohio
Grade	6 - 8	
Strand	Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects 6–12	
Topic	Productions and Distribution of Writing	
Standard	4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. 6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.	

Add Standard	English Language Arts	Ohio
Grade	6 - 8	
Strand	Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects 6–12	
Topic	Research to Build and Present Knowledge	
Standard	7. Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. 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. 9. Draw evidence from literary or informational texts to support analysis, reflection, and research.	

Add Standard	English Language Arts	Ohio
Grade	7	
Strand	Speaking and Listening Standards for Literacy in History/Social Studies, Science and Technical Subjects 6–12	
Topic	Presentations of Knowledge and Ideas	

Add Standard	English Language Arts	Ohio
Standard	4. Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation 5. Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.	

Add Standard	Social Studies	Ohio
Grade	7	
Theme		
Strand (pk-8 only)	History	
Topic	Earl Civilizations	
Content Standard	The civilizations that developed in Greece and Rome had an enduring impact on later civilizations. This legacy includes governance and law, engineering and technology, art and architecture, as well as literature and history. The	

Add Standard	Science	Ohio
Grade	7	
Theme	Order and Organization	
Topic	Physical Science: Conservation of Mass and Energy	

Add Standard	Science	Ohio
Content Standard	Energy can be transferred through a variety of ways. Energy can be transferred through radiation, convection, and conduction 9p. 253. --- elaboration: 3 Waves can be described by their speed, wavelength, amplitude and frequency. The energy of a mechanical wave depends upon the material, decreases with increasing wavelength, and increases with amplitude. The pitch of a sound wave increases with the frequency and the loudness increases with amplitude. While light and other electromagnetic waves do not require a medium and can travel through a vacuum, they can travel through some media, such as clear glass. A wave travels at a constant speed through a particular material as long as it is uniform (e.g., for water waves, having the same depth). The speed of the wave depends on the nature of the material (e.g.,	

Add Standard	Science	Ohio
Grade	7	
Theme	Order and Organization	
Topic	Physical Science: Conservation of Mass and Energy	
Content Standard	Energy can be transformed or transferred but is never lost. When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. When energy is transformed from one form to another, the total amount of energy remains the same. Note: Further discussion of energy transformation is addressed at the high school level. Concepts:	

Add Standard	Science	Ohio
Strand		
Course Content		
Content Elaboration		

Add Standard	**Fine Arts**
Grade	
Subject	
Standard	
Benchmark	
Indicator	

Add Standard	**Technology**
Grade	7
Standard	Technology Development
Benchmark	Analyze information relative to the characteristics of technology and apply in a practical setting.
Indicator	1. Describe the factors involved in developing products and systems using technology (e.g., market survey, design, development, prototyping, assessing, producing, quality assurance, marketing). 2. Develop technological solutions to problems. 3. Discuss ways that technology is linked to creativity and innovation.

Add Standard	**Technology**
Grade	7
Standard	Technology Interaction
Benchmark	Analyze the relationships among technologies and explore the connections between technology and other fields of study.
Indicator	1. Describe the situational interdependence of technologies (e.g., space shuttle crew depends on communication technologies in order to maneuver the craft). 2. Identify products that have been applied to alternative settings. 3. Explain how knowledge from other fields of study may impact the development of technological systems and products.

Assessment Plan

What evidence will show that students have acquired the enduring understandings for this STEM unit?

Performance Task, Projects	Stained-Glass Window
Quizzes, Tests, Academic Prompts	Pre/post Test Cost Analysis
Other Evidence (e.g. observations, work samples, student artifacts, etc.)	Design Sketches Team Design Presentation Report Handouts
Student Self- Assessment	Technical Reports Handouts

Technology Integration

ADISC Technology Integration Model*

	Type of Integration	Application(s) in this STEM Unit
A	Technology tools and resources that support students and teachers in ***adjusting, adapting, or augmenting*** teaching and learning to meet the needs of individual learners or groups of learners.	YouTube video to get students thinking about the technology in windows. The SmartBoard lesson where students are interacting with the definitions.
D	Technology tools and resources that support students and teachers in ***dealing effectively with data***, including data management, manipulation, and display.	Thermometers help students collect and analyze data.
I	Technology tools and resources that support students and teachers in conducting ***inquiry***, including the effective use of Internet research methods.	SmartBoard Internet Prezi Presentation
S	Technology tools and resources that support students and teachers in ***simulating*** real world phenomena including the modeling of physical, social, economic, and mathematical relationships.	Part of the SmartBoard lesson where students are simulating the effects of temperature and the movement of particles in the states of matter.

C	Technology tools and resources that support students and teachers in ***communicating and collaborating*** including the effective use of multimedia tools and online collaboration.	The teacher communicates with the principal to discuss the cost to the building of heating and cooling.
	**The ADISC Model was developed by James Rowley PhD, Executive Director of the Institute for Technology-Enhanced Learning at the University of Dayton*	

Career Connections

Career Description

Students could apply this lesson in many fields. For example, most buildings are now designed to be insulative, so that they can be cool in the summer and warm in the winter. Careers that involve this include architecture, construction, and civil engineering. This lesson is also applicable to art in its use for stained glass and can be used to construct tinted windows for vehicles. Finally, this is also used in renewable energy production, such as solar cell and solar thermal plants.

Section II: STEM Lesson Plan

Title of Lesson

Day 1: Introduction and History

Time Required

50 minutes

Materials

Appendix A: Pre/Post-Test (1 per student)
Appendix B: Pre/Post-Test Answer Key (1 per teacher)
Appendix C: Windows Around the World (1 per student)
Appendix D: Ancient Art? Article (1 per student)
Prezi Presentation: http://prezi.com/dapaqptokrzz/around-the-windows-looking-through-stained-glass/
"Smart Window" video (on Prezi presentation) or: http://www.youtube.com/watch?v=m5rlTrdF5Cs
"PBS Stained Glass" video (on Prezi presentation) or: http://pbskids.org/dragonflytv/show/stainedglass.html

---

Objectives

Students will be able to describe how stained glass windows were originally created and how the spread of Christianity and culture affected the daily lives of ancient civilization.

Students will be able to describe the Engineering Design Challenge presented to them.

Instructional Process

1. Administer Pretest.
2. Display the Prezi presentation and describe the Engineering Design Challenge. Instruct students to complete numbers 1 and 2 on Windows Around the World
2. Have the students view the video on the Prezi: "CES - Samsung's Smart Window"
3. After the video, instruct students to begin to fill out the questions on the Windows Around the World handout.
4. Continue the Prezi Presentation as students complete the Windows Around the World handout for "Ancient Art".
5. Show students the Stained Glass video from PBS to give them a visual representation of how stained glass windows are created.
6. Have students answer "Ancient Art?" questions, and then split them into groups of 3 to complete a group-reading assignment from Appendix C.

Differentiation

Utilize Pretest results as a guide for modifying the unit for individual students or classes as necessary.
Scaffold Windows Around the World Handout.

Assessments

Pretest
Windows Around the World Handout
Ancient Art Handout

Section II: STEM Lesson Plan

Title of Lesson	**Day 2: Code of Cooperation and Engineer Design Process**
Time Required	50 Min
Materials	Appendix E: Team Code of Cooperation (1 per team) Notebook Paper (1 per student) Sticky Notes (10 per student) Prezi Presentation: http://prezi.com/dapaqptokrzz/around-the-windows-looking-through-stained-glass/
Objectives	Students will be able to describe and understand the engineering design process. Students will be able to create a Code of Cooperation to build a more a effective team.


The Dayton Regional
STEM Center
Science, Technology, Engineering and Math

Instructional Process

1, Instruct students to work with their teams to create a Code of Cooperation that each team member will sign and agree to follow.
2. Follow the Prezi Presentation, Day 2 to present students with the definition of the engineering design process and complete the following:

1. Step 1: Define the Problem
   a. Bug List: Have students create a bug list, a list of things in everyday life that bug them, like shoes coming untied or iPod cords getting tangled. This method is useful if introducing the idea of a problem definition or if students need to come up with a problem to solve themselves.
   b. Objectives and Constraints: Have students come up with a list of things that the product they plan to make has to accomplish and things that are desired, but not necessary. Things that are simply desired are called objectives, and things that are necessary are called constraints. For the shoelace problem one might have the following list.
      Objectives:
      1. Stop shoelaces from becoming tangled
      2. Be as light as possible
      Constraints:
      1. Cost less than $5.00
      2. Be less than 2 lbs.
   c. Problem Statement: have students write a problem statement. It must describe or define the problem and include the objectives and constraints. For example, one might say the following for the shoelace problem:
      "Local 7th graders are frustrated that their shoes become untied. As a result, a group of 7th graders decided to design a product that stops shoe laces from becoming untied and is as light as possible. They need it to be less than 2 lbs. and cost less than $5.00."
   d. This might be useful to do as a group with a problem the students come up with in the bug list. This will help introduce them to it so that when they do it in a real project, they know what to do.
2. Brainstorming/Idea generation
   a. Post-It-Note brainstorming: Give each student a stack of post it notes and separate them into teams of four. Have them individually write or draw ideas on the post it notes for a period of time (ex. 3 min) or have
      them generate a certain number of ideas. (ex 5) Then, have them share their ideas in their groups and build new ideas from these.
   b. Have your students decide which ideas they like the best(3 to 4 is optimal)
3. Design Selection
   a. Design Matrix: Engineers like to make decisions logically and with little subjectivity. As a result, they make use of what is called a design matrix.
   b. Decide the importance of the objectives made in class. Give them a number weight from 1 to 10 either on your own or with your students. (10 is most important and 1 is least) Take three or four design ideas and rank how well they meet the objectives by giving them a rank 1 through 10.(10 is good and 1 is poor) Multiply each objective weight by its corresponding idea rank and add all the results for each idea together. The one with the highest score is, logically, the one to choose to make. This is useful to do in chart form, either written on a board or in a program like Excel. A simple chart is displayed on the Prezi.
   c. Note: Any designs that do not fit constraints cannot be used.
4. Design Construction
   a. Working designs (also called prototypes) can be built of almost anything. They can be made from simple classroom materials like cardboard to complex materials like plastic or metal. Choice of materials, and the building process, is up to the designers.
   b. For the purpose of a classroom introduction to the engineering process, nothing really needs to be built. However, if a project is assigned to students, it is useful for students' learning to build a working prototype of their design.
5. Testing the Design
   a. Any tests need to be modeled after the objectives and constraints. In other words, the results of the test need to directly show whether or not the prototype met the objectives and the constraints. For example, one might test a product that is meant to keep shoelaces tied by having a group of students run with and without the product. Data collected would include whether or not their laces came undone both with and without the device. Any significant difference in the two data sets would indicate that the device is effective. No difference would indicate that the device is not effective.
6. Results
   a. Results can be presented to whoever asked for the device. (ex: a teacher or a company) Any presentation would need to include how the design group went through all of the steps of the process above.

Differentiation	Heterogeneous teaming.
Assessments	Code of Cooperation Bug list Post-it note brainstorming

Section II: STEM Lesson Plan

Title of Lesson

Day 3: Properties of Tangram Shape

Time Required

50 minutes

Materials

Appendix F: Geometric Shapes for a Stained Glass Window (1 per student)
Prezi Presentation: http://prezi.com/dapaqptokrzz/around-the-windows-looking-through-stained-glass/
2-Liter Bottles (two per team)
Red, Green, and Blue Tissue Paper (one square foot each color)
Rulers
Protractors
Scissors

Objectives

Students will be able to list and find missing angle measurements in different shapes. Students will be able to explain where pi derives from and why it is used in equations involving circles.

Instructional Process

1. Display Day 3 of the Prezi presentation, having students follow along with the presentation.
2. Discuss the concept of Total Angle Measurement
3. Instruct students to observe various shapes (triangle, rectangle, pentagon, hexagon, octagon) and record measurements and types of angles they observe.
4. Have students discuss how they might be able combine various shapes without gaps.
5. Introduce tangrams and have students make shapes on their own, and then complete the tangram on the worksheet.
6. As an exit slip, ask students to use their template to begin sorting the shapes they wish to use on their stained glass window. They should sketch this on a piece of notebook paper before the next class period.

Differentiation

Students should be allowed to manipulate the Tangrams into different shapes, and templates can be provided for this.

The angles of the shapes could be added to Appendix F before distributing the page to students.

Assessments

Completed Geometric Shapes for a Stained Glass Window

Section II: STEM Lesson Plan

Title of Lesson

Days 4 and 5: Energy and Heat Transfer

Time Required

100 minutes (two 50 minutes classes)

Materials

Computer with Projection Capapilities
SmartBoard
SmartBoard Presentation: Thermal Energy
Appendix H: Thermal Energy (SmartBoard Interactive Lesson)
Appendix G: Energy and Heat Transfer (1 per student)

Materials (make available for teams to choose from as they design a testing method):
2-Liter Bottles (3 per team)
Red, Green, and Blue Tissue Paper (one square foot each color)
Ruler (1 per team)
Transparent Tape
Room Temperature Water (2 gallons per team)
Playdough (1 per team)
Thermometers (3 per team)
Rubber Bands (3 per team)
Clear Page Protector (1 per team)

Objectives

Students will measure temperature change of water as light shines into a 2-liter bottle through various colors of tissue paper.

Instructional Process

1. Introduce vocabulary terms convection, conduction, and radiation (SmartBoard lesson).
2. Present design challenge to students (included in SmartBoard lesson).
3. Assign student teams, of three to four individuals, and have them choose their roles for the design challenge (recorder, materials acquisition and time management, engineering lead).
   - Students should use provided materials and design an experiment to measure temperature change of water caused by light transmittance through an assigned color of tissue paper in comparison to a transparent container without a covering.
   - Project specifications: Light should only be able to enter the container through the colored tissue paper or the clear surface. Students should design some way of eliminating error from light entering the container with tissue paper through any surface that is not the color of the tissue paper.
4. Instruct teams to decide testing parameters, and then hand out materials for the test bottles.
5. Have students create their set-up. Remind them they will need to be able to observe the thermometer periodically.
6. Instruct students to place containers in sunny window (or under a light source) and measure temperature change of water. This will require several hours.
7. Closure: students should present their set-up to the other teams to discuss how they eliminated light getting through the bottle walls without blocking it completely.

Differentiation

Scaffold Energy and Heat handout. Assist students in setting up their graph for the discussion section.

Assessments	Thermal Energy handout Energy and Heat Transfer handout Collected experimental data

Section II: STEM Lesson Plan

Title of Lesson

Days 6: Data Collection from Containers and Preliminary Window Design

Time Required

50 minutes

Materials

Appendix K: Engineering Design Challenge Rubric (1 per student)
Appendix L: Stained Glass Window Creation (1 per team)
Appendix M: Stained Glass Window Creation Teacher Guide (1 per teacher)
Appendix O: Tangram Puzzle Cutout (1 per student)

Materials (make available for teams to choose from as they design a testing method):
2-Liter Bottles (3 per team)
Red, Green, and Blue Tissue Paper (one square foot each color)
Ruler (1 per team)
Transparent Tape
Room Temperature Water (2 gallons per team)
Playdough (1 per team)
Thermometers (3 per team)
Rubber Bands (3 per team)
Clear Page Protector (1 per team)

Objectives

Students will analyze and discuss data collected from their design and draw inferences regarding the use of colored paper as a window shade.

Instructional Process

1. Review data collected in Energy and Heat challenge.
2. Begin preliminary designs for stained glass window.

Differentiation

Monitor groups and ask leading questions as necessary.

Assessments

Collected data
Observation

Section II: STEM Lesson Plan

Title of Lesson

Day 7: Window Testing and Redesign

Time Required

50 minutes

Materials

Prezi Presentation: http://prezi.com/dapaqptokrzz/around-the-windows-looking-through-the-kaleidoscope/
Computers (1 per student)
Appendix N: Final Presentation Rubric (1 per student)

Objectives

Students will communicate their understanding of the engineering design process and thermal energy transfers through technical writing and presentation.

Instructional Process

1. Give students time to complete their data collection and compilation.
2. Display Prezi presentation to introduce technical writing requirements.
3. Distribute Final Presentation Rubric.
4. Allow time for teams to prepare reports and presentations.
5. Homework: Instruct teams to divide tasks amongst themselves for completion of report and presentation.

Differentiation

Provide a scaffold for technical report guidance.

Assessments

Final Presentation Rubric
Technical Report

Section II: STEM Lesson Plan

Title of Lesson	**Day 8: Presentation Preparation**
Time Required	50 minutes
Materials	Computers (1 per student) Appendix N: Final Presentation Rubric (1 per student)

Objectives	Students will utilize their compiled data and technical report to discuss their findings with the class.
Instructional Process	1. Allow half of the period for wrapping up reports and presentations. 2. Have teams present their presentations and turn in their technical reports.
Differentiation	
Assessments	Technical Report Final Presentation Rubric

Section II: STEM Lesson Plan

Title of Lesson	**Day 9: Finish Presentations and Post-Test**
Time Required	50 minutes
Materials	Appendix N: Final Presentation Rubric Appendix A: Post-Test Appendix B: Post-Test Answer Key

---

Objectives	Students will present their findings and demonstrate their final product. Students will demonstrate understanding of unit concepts by completing a post-test.
Instructional Process	1. Finish presentations. 2. Administer Post-Test.
Differentiation	Modify post-test for individual students as necessary.
Assessments	Final Presentation Rubric Post-Test

Section III: Unit Resources

Materials and Resource Master List

Appendices
Prezi.com presentation: http://prezi.com/dapaqptokrzz/around-the-windows-looking-through-the-kaleidoscope/
SmartBoard Presentation: Thermal Energy
A Brief History of Stained Glass: http://www.stainedglassmuseum.com
Stained Glass: http://pbskids.org/dragonflytv/show/stainedglass.html
Playground Ball
Large pieces of red, green, and purple tissue paper
Sticky notes
Markers
Tangram Puzzles (1 per team)
2-Liter Bottles (3 per team)
Scissors
Rulers
Thermometers (3 per team)
Large bag of translucent colored beads
Transparent tape
Room Temperature Water (Materials (make available for teams to choose from as they design a testing method):
2-Liter Bottles (3 per team)
Red, Green, and Blue Tissue Paper (one square foot each color)
Ruler (1 per team)
Transparent Tape
Room Temperature Water (2 gallons per team)
Playdough (1 per team)
Thermometers (3 per team)
Rubber Bands (3 per team)
Clear Page Protector (1 per team)
Blank Overhead Transparencies (1 per team)
Ruler (1 per team
Playdough or Modeling Clay (1 container per team)

Key Vocabulary

Acute Angle
an angle whose measure is more than 0degrees and less than 90 degrees

Conduction
process of moving energy from one object to another when they are physically touching

Convection
energy is transferred through the movement of gases or liquids

Diameter
the distance across a circle through its center

Law of Conservation of Energy
one form of energy can be transferred into another form of energy but is never lost.

Obtuse Angle
an angle whose measure is more than 90 degrees and less than 180 degrees

Radiation
energy that travels as electromagnetic waves, which includes visible light, microwaves, and infrared light.

Right Angle
an angle which is 90 degrees

Technical Brief

Acute Angle
an angle whose measure is more than 0degrees and less than 90 degrees

Conduction
process of moving energy from one object to another when they are physically touching

Convection
energy is transferred through the movement of gases or liquids

Diameter
the distance across a circle through its center

Law of Conservation of Energy
one form of energy can be transferred into another form of energy but is never lost.

Obtuse Angle
an angle whose measure is more than 90 degrees and less than 180 degrees

Radiation
energy that travels as electromagnetic waves, which includes visible light, microwaves, and infrared light.

Right Angle
an angle which is 90 degrees

Safety and Disposal

Students should wear safety goggles and understand how to be cautious around sharp objects. Students also need to be aware that the beads are a chocking hazard.

References

Cornell NanoScale Science and Technology Facility. (2008). The five senses Nanooze , (3), 6. Retrieved from http://www.nanooze.org/english/pdfs/nanoozeissue_03.pdf

Dayton Regional STEM Center. (May 1, 2010). Let's heat things up. Retrieved from http://www.daytonregionalstemcenter.org/uploads/curriculum/LetsHeatThingsUP_STEM_DoD.pdf

McDougal. (2007). Matter and energy. Boston, MA: Houghton Mifflin Company.

Saxon, H. (2004). Saxon math 8/7 with prealgebra. (Vol. 1). Norman, OK: Saxon Publishers, INC

Saxon, H. (2004). Saxon math 8/7 with prealgebra. (Vol. 2). Norman, OK: Saxon Publishers, INC

Saxon, H. (2004). Saxon math 7/6. (Vol. 1). Norman, OK: Saxon Publishers, INC

Saxon, H. (2004). Saxon math 7/6. (Vol. 2). Norman, OK: Saxon Publishers, INC

Stained Glass Museum. (2013). A brief history of stained glass. Retrieved from http://www.stainedglassmuseum.com.

Public Broadcasting Service. (2013). Dragon Fly TV: stained glass. Retrieved from: http://pbskids.org/dragonflytv/show/stainedglass.html

Curriculum Developers

Katy Jo Brown: Contributing Author, Editor
Jeanette McNally: Contributing Author, Editor
Sandi Preiss: Editor
Benjamin Schultheis: Contributing Author
Erin Taylor: Contributing Author
Jessica Tynan: Contributing Author
Erin Yacovoni: Contributing Author

Section IV: Appendices

Appendix A: Pre / Post Test
Appendix B: Pre / Post Test KEY
Appendix C: Windows Around the World
Appendix D: Ancient Art? Article
Appendix E: Team Code of Cooperation
Appendix F: Shape Cutouts
Appendix G: What Kind of Pi Do We Have?
Appendix H: Thermal Energy (SmartBoard Interactive Lesson)
Appendix I: Energy and Heat Transfer
Appendix J: Energy and Heat Transfer, TEACHER GUIDE
Appendix K: Engineering Design Challenge Rubric
Appendix L: Kaleidoscope Creation
Appendix M: Kaleidoscope Creation Teacher Guide
Appendix N: Final Presentation Rubric