

Seymour Public Schools Curriculum

Grade Eight Science, Technology, Engineering & Math (STEM) Curriculum

The purpose of this class is to use hands-on experiences and real-world applications to expand upon the skills students learned during the seventh grade year of STEM.

Unit 1 – Carbon Footprint

Students will be introduced to greenhouse gases and global warming. They will learn about carbon as an element and as a part of compounds. They will learn what fossil fuels are and where they came from. Students will also learn about the natural carbon cycle and the effects people have on it. Students will learn factors that are included in a carbon footprint and how to measure their own carbon footprint. Students learn what they can do to lessen their negative impact on the environment.

Unit 2 – Eco-Architecture

Students will explore sustainable construction methods that designers and engineers use currently. Students will learn how to evaluate the benefits and drawbacks of building materials based on the Six-Question Sustainability Test. They will learn the importance of building for sustainability and learn why we need to reduce, reuse, recycle, and rethink when planning for new construction. Ultimately, students will design and create their own Eco-home that represents choices they have made about designing with the environment in mind.

Unit 3 – Alternative Energy

Students will explore the basic concepts of energy, as well as the law of conservation of energy. Information will be presented about renewable and nonrenewable energy sources and how these resource types are important for meeting global energy demands. The advantages and disadvantages of alternative energy forms such as solar, wind, biomass, geothermal, and hydropower will be presented. Hands-on experiences will include experiments with a wind turbine, solar cells, and hydrogen fuel cells.

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UNIT 1- Carbon Footprint

Subject: Grade: Time Frame:	STEM 8 August-October (6 Weeks)
CCSS Overarching Standards	Literacy Standards CCSS.ELA-LITERACY.RST.6-8.4 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. CCSS.ELA-LITERACY.RST.6-8.10 By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently. Math Standards CCSS.MATH.CONTENT.7.RP.A.2 Recognize and represent proportional relationships between quantities.
Enduring Understanding	The greenhouse effect, global warming, and climate change are different from each other, but are interrelated. An individual's carbon footprint is impacted by the amount of greenhouse gases he/she creates through his/her choices and actions. The carbon footprint of highly-developed countries (such as the U.S.) has an impact on other, less developed countries.
Essential Questions	What are the primary differences between the greenhouse effect, global warming, and climate change? How are the greenhouse effect, global warming, and climate change interrelated? How can a person decrease his or her carbon footprint? How does the carbon footprint of the United States impact other, less developed countries?
Priority Standards	Common Core State Standards CCSS.ELA-LITERACY.RST.6-8.7 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). CCSS.MATH.CONTENT.7.RP.A.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. CCSS.MATH.CONTENT.8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. Connecticut Technology Education Standards IT.02.02 Examine how technology use changes our environment. IT.03 Explain the effects of technology on the environment ➤ IT.03.03 Recognize and explain that technological changes and advances have consequences for the immediate environment.

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	<ul style="list-style-type: none"> ➤ IT.03.04 Evaluate local, regional or global issues surrounding technology. 	
<p>Performance Expectations</p> <p>(Student outcomes)</p>	<ul style="list-style-type: none"> ➤ Define the term <i>carbon footprint</i> and explain its significance. ➤ Identify carbon as an element and a part of compounds. ➤ Explore Earth's carbon cycle including major carbon sources and sinks. ➤ Explain how greenhouse gases relate to an individual's carbon footprint. ➤ Explore fossil fuels, where they came from, and how they affect the carbon footprint. ➤ Analyze the transportation, agriculture, energy, and consumer sectors of the carbon footprint. ➤ Brainstorm ways to decrease an individual's carbon footprint without changing the quality of life. <p>Common Core State Standards</p> <p>CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p> <p>CCSS.ELA-LITERACY.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.</p> <p>CCSS.MATH.CONTENT.7.RP.A.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.</p> <p>CCSS.MATH.CONTENT.7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.</p>	
<p style="text-align: center;">Strategies/Modes</p> <ul style="list-style-type: none"> ➤ Modeling ➤ Guided practice ➤ Class/Small-group discussions ➤ Student-determined pacing ➤ Laboratory experiments ➤ Data collection & analysis ➤ Hands-on learning 	<p style="text-align: center;">Materials/Resources</p> <ul style="list-style-type: none"> ➤ Synergy ITC presentations ➤ Online dictionary ➤ Teacher-created supplemental materials ➤ Graphic organizers ➤ Calculators ➤ Carbon footprint logbooks ➤ Grid paper ➤ Poster board ➤ Plastic cups ➤ Wash bottles ➤ Graduated beakers ➤ Digital thermometers ➤ Digital timers 	<p style="text-align: center;">Assessments</p> <p><u>Summative Assessment</u></p> <ul style="list-style-type: none"> ➤ End of unit questions from Synergy ITC. ➤ Poster project: students must design a billboard to make others aware of ways to lessen our carbon footprints. A rubric will be provided. <p><u>Formative Assessments</u></p> <ul style="list-style-type: none"> ➤ Pre-test ➤ Research, Challenge & Application (RCA): quizzes throughout the unit ➤ Performance assessments ➤ Problem-solving questions ➤ Exit slips

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| | <ul style="list-style-type: none">➤ Gooseneck lamps➤ "Green Game" board game➤ Light meters➤ Meter sticks➤ Molymod "Organic & Inorganic Chemistry Kits"➤ Sand➤ Sand shovels➤ Plastic tubing➤ Binder clips➤ 12CC syringes➤ Plastic wrap➤ Baking soda➤ 9-volt batteries | <ul style="list-style-type: none">➤ Data reports |
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UNIT 2- Eco-Architecture

Subject: Grade: Time Frame:	STEM 8 November-January (6 Weeks)
CCSS Overarching Standards	Literacy Standards CCSS.ELA-LITERACY.RST.6-8.4 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. CCSS.ELA-LITERACY.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. CCSS.ELA-LITERACY.RST.6-8.10 By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently. Math Standards CCSS.MATH.CONTENT.7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
Enduring Understanding	Building materials need to be assessed in a variety of ways in order to be used as part of a green construction. There are many different types of green construction, each with their own unique methods. Heat is transferred differently through different types of materials. These differences impact the selection of materials to use for a construction project.
Essential Questions	What criteria are used to evaluate building materials? How are straw bale, earth-sheltered, rammed-earth, and Earthship construction methods similar? How are they different? Why is the water cycle important to Earthship design? How can one determine which type(s) of material(s) to use for insulation in a construction project?
Priority Standards	Common Core State Standards CCSS.ELA-LITERACY.RST.6-8.7 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). CCSS.MATH.CONTENT.7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. Connecticut Technology Education Standards DD.03.10 Identify the factors used to select the designs for structures based on building laws and codes, style, convenience, cost

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	climate, and function.	
Performance Expectations (Student outcomes)	<ul style="list-style-type: none"> ➤ Evaluate building materials based on the Six-Question Sustainability Test. ➤ Review LEED classifications that are used for green construction. ➤ Demonstrate how insulation works, including the benefits of green roofs. ➤ Create a thermal wall to understand the process of heat transfer. ➤ Explain the water cycle and how this is an integral part of Earthship design. ➤ Explore the benefits of straw bale, earth-sheltered, rammed-earth, and Earthship construction methods. <p>Common Core State Standards</p> <p>CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</p> <p>CCSS.MATH.CONTENT.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.</p> <p>CCSS.MATH.CONTENT.6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.</p> <p>CCSS.MATH.CONTENT.6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:</p> <ul style="list-style-type: none"> ➤ CCSS.MATH.CONTENT.6.SP.B.5.A Reporting the number of observations. ➤ CCSS.MATH.CONTENT.6.SP.B.5.B Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. <p>Connecticut Technology Education Standards</p> <p>IT.02 Recognize and explain the cultural, social, economic, and political effects of technology.</p> <p>IT.03 Explain the effects of technology on the environment.</p>	
Strategies/Modes	Materials/Resources	Assessments
<ul style="list-style-type: none"> ➤ Modeling ➤ Guided practice ➤ Class/Small-group discussions ➤ Student-determined pacing ➤ Hands-on learning ➤ Laboratory experiments ➤ Creating models 	<ul style="list-style-type: none"> ➤ Synergy ITC presentations ➤ Online dictionary ➤ Teacher-created supplemental materials ➤ Graphic organizers ➤ Calculators ➤ "Eco-Architecture Consumables Kit" ➤ Gooseneck lamps ➤ Potting soil ➤ Sandpaper ➤ Chipboard ➤ Felt 	<p><u>Summative Assessment</u></p> <ul style="list-style-type: none"> ➤ End of unit questions from Synergy ITC. ➤ Final project: design an eco-friendly home. (A rubric will be provided.) <p><u>Formative Assessments</u></p> <ul style="list-style-type: none"> ➤ Pre-test ➤ Research, Challenge & Application (RCA): quizzes throughout the unit ➤ Performance assessments ➤ Problem-solving questions ➤ Exit slips ➤ Laboratory reports

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| | <ul style="list-style-type: none">➤ Light bulbs➤ Squeeze bottles➤ Digital timers➤ Rulers➤ Scissors➤ Small shovels➤ "Sunpower house" | |
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UNIT 3- Alternative Energy

Subject: Grade: Time Frame:	STEM 8 November-January (6 Weeks)
CCSS Overarching Standards	Literacy Standards CCSS.ELA-LITERACY.RST.6-8.10 By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently Math Standards CCSS.MATH.CONTENT.6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. CCSS.MATH.CONTENT.6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers. CCSS.MATH.CONTENT.7.RP.A.2 Recognize and represent proportional relationships between quantities.
Enduring Understanding	There are three types of energy sources: renewable, nonrenewable, and perpetual. There are several types of alternative energy sources which are renewable. A fuel cell is a device that converts chemical energy in a fuel into electricity.
Essential Questions	What are the differences between renewable, nonrenewable and perpetual energy sources? What types of alternative energy sources are available? Why should people use alternative energy sources? What are some challenges to using alternative energy sources? How does a fuel cell work?
Priority Standards	Common Core State Standards CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. CCSS.ELA-LITERACY.RST.6-8.7 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). CCSS.MATH.CONTENT.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations CCSS.MATH.CONTENT.6.EE.C.9

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	<p>Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.</p> <p>CCSS.MATH.CONTENT.7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.</p> <p>CCSS.MATH.CONTENT.8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.</p> <p>Connecticut Technology Education Standards EKS.05.11 Evaluate alternatives using a variety of problem-solving and critical thinking skills. NT.01.09 Describe technology as a process for transforming raw materials into useful goods and services NT.01.014 Describe how and why people use technology to modify their natural environment and the impact of those modifications. IT.03 Explain the effects of technology on the environment.</p>
<p>Performance Expectations (Student outcomes)</p>	<ul style="list-style-type: none"> ➤ Learn the characteristics of renewable and nonrenewable energy resources. ➤ Explore traditional and nontraditional, or alternative, forms of energy. ➤ Gain an understanding of the scientific law of conservation of energy. ➤ Learn about the use of wind energy and perform an efficiency experiment using a wind turbine. ➤ Learn the important role the Sun plays in the production of energy on Earth. ➤ Explore hydropower and geothermal power. ➤ Complete a fermentation experiment to explore biomass energy. ➤ Perform an experiment to simulate hydrogen fuel cell technology. ➤ Evaluate various energy resources and draw conclusions based upon statistical data. <p>Common Core State Standards CCSS.ELA-LITERACY.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.</p> <p>CCSS.MATH.CONTENT.6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.</p> <p>CCSS.MATH.CONTENT.6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:</p> <ul style="list-style-type: none"> ➤ CCSS.MATH.CONTENT.6.SP.B.5.A Reporting the number of observations. ➤ CCSS.MATH.CONTENT.6.SP.B.5.B Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

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	<ul style="list-style-type: none"> ➤ CCSS.MATH.CONTENT.6.SP.B.5.C Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. ➤ CCSS.MATH.CONTENT.6.SP.B.5.D Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. <p>CCSS.MATH.CONTENT.7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.</p> <p>CCSS.MATH.CONTENT.7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.</p> <p>Connecticut Technology Education Standards EKS.04.02 Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification.</p>	
<p style="text-align: center;">Strategies/Modes</p> <ul style="list-style-type: none"> ➤ Modeling ➤ Guided practice ➤ Class/Small-group discussions ➤ Student-determined pacing ➤ Hands-on learning ➤ Laboratory experiments 	<p style="text-align: center;">Materials/Resources</p> <ul style="list-style-type: none"> ➤ Synergy ITC presentations ➤ Online dictionary ➤ Teacher-created supplemental materials ➤ Graphic organizers ➤ Calculators ➤ Aluminum foil ➤ Balloons ➤ Corks ➤ Corn syrup ➤ Disposable gloves ➤ Salt ➤ Straws ➤ "Test Tube Con Kit" ➤ Thumb tacks ➤ Yeast ➤ .45 Volt solar panels ➤ .5 Volt 800ma solar panels ➤ 1 Volt 200ma solar panels ➤ 2 Volt 200ma solar panels ➤ Wash bottles 	<p style="text-align: center;">Assessments</p> <p><u>Summative Assessment</u></p> <ul style="list-style-type: none"> ➤ End of unit questions from Synergy ITC. <p><u>Formative Assessments</u></p> <ul style="list-style-type: none"> ➤ Pre-test ➤ Research, Challenge & Application (RCA): quizzes throughout the unit ➤ Performance assessments ➤ Problem-solving questions ➤ Exit slips ➤ Laboratory reports

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	<ul style="list-style-type: none">➤ Specimen jars➤ Rulers➤ Binder clips➤ Fans➤ Glass stirring rods➤ Gooseneck lamps➤ Measuring spoons➤ Newton's cradle➤ Scissors➤ Test tube brushes➤ Test tube multi rack➤ Towels➤ Wind meters➤ "Windynamo II Demo Box"➤ "Windynamo III Fan Assembly"➤ Wire test leads	
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