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GREEN ARCHITECTURE Student Day Resource Packet

Pre & Post Visit Activities ▪ Vocabulary & Resource Lists ▪ Curriculum Connections

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Before Your Visit :

Prepare your students for their visit with these introductory pre-visit activities.

1	Ensure that students understand the context for "green" or sustainable design efforts by having them do some research about climate change. The United States Green Building Council has created the website www.learninglab.usgbc.org to be used as an online resource for K-12 educators. Help your students identify some challenges that affect our cities.
2	Introduce the *Green Architecture Vocabulary List* on Page 3 to your students so they can be active participants during our discussion at the Center for Architecture.

During Your Visit :

The program begins by asking students to consider the changes we have made to the natural environment. After an in-depth presentation about strategies we can use to create environmentally friendly buildings, students will have a chance to create their own models incorporating these ideas. During this process, students will discover how each element of their design can work together to create a more sustainable structure. Students will be challenged to use our modified version of the LEED (Leadership in Energy and Environmental Design) checklist to think about the importance of site planning, alternative energy systems, building design, and resource conservation and try to achieve a silver, gold or platinum rating for their design.

After Your Visit :

Continue the learning by facilitating these suggested extension activities.

1	**Direct and Indirect Light Experiment:** Use the *Direct and Indirect Light Experiment* activity sheet on Page 4 to encourage your students to consider the effects of the seasons on the natural and built environment. Answer Key: 1) Parts of the world that receive the most direct sunlight (the equator) are the warmest. Similarly, summer is the warmest season because our hemisphere receives more direct sunlight due to the earth's tilt. 2) Solar panels should try to face 90° to the sun to maximize their production of solar power.
2	**Solar Updraft Experiment:** Use the *Solar Updraft Experiment* activity sheet on Page 5 to test ideas about natural ventilation. Challenge your students to consider if they can adapt this experiment to test ideas about wind power. Answer Key: 1) As the sun warms the tin cans, this heat is transferred to the air contained within them. As the hot air rises from the top, fresh air replaces it from below. This movement causes the pinwheel to turn. 2) Students may suggest vertical ventilation systems that allow the hot air to escape through the top of a building, bringing in fresh air from lower levels.
3	**Green City Design:** Ask your students to change their scale of thinking by using the models they made at the Center to design a green city as a class. How do their individual models relate to each other and what additional systems need to be added to make the city successful? Transportation? Energy generators?

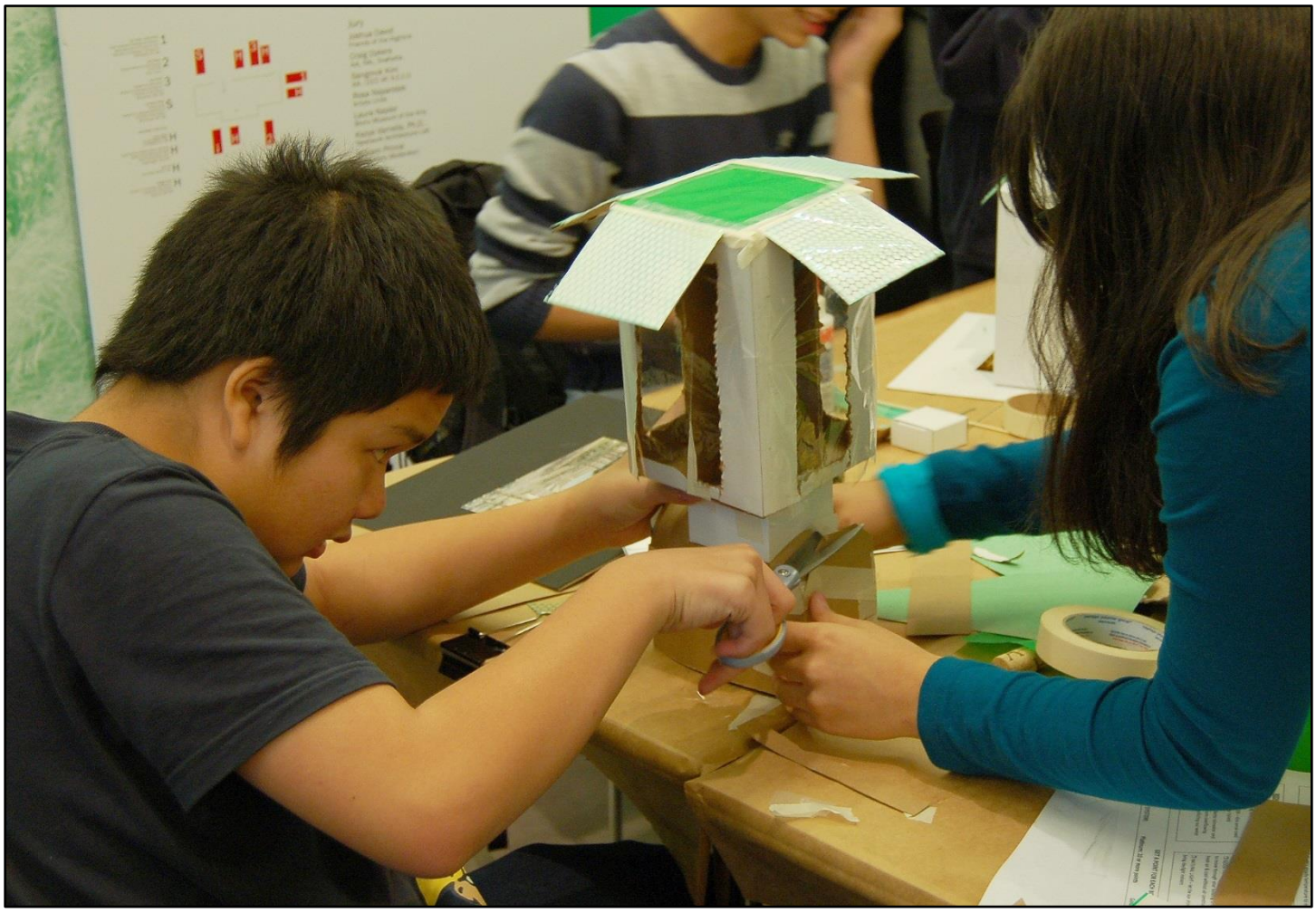
After Your Visit (continued)

Writing Activity: Use the writing prompts below to help your students consider environmental design through a new lens.

4

Using the SEED checklist and other sources as needed, explain the design decisions you made to create your green building model. How does your design function to achieve the goal of making progress towards sustainability?

Find and research a school building that achieved LEED status. What decisions did the designers make to achieve this goal? Based on your research, are there any ideas that you can propose for your own school to be more green?



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Green Architecture Vocabulary List

Geothermal Power	A form of energy generated by harnessing the heat trapped in the Earth's core. Some geothermal systems use this heat energy to generate electricity. Others use the constant temperature of Earth's crust as a sustainable resource to assist with heating and cooling a building.
Gray Water	The relatively clean waste water from baths, sinks, washing machines, and other appliances.
Green Design	Green design is an approach to design that seeks to minimize the impact of human activity on the natural environment.
Green Roof	A roof that is partly or entirely covered by plants, growing in light-weight soil on top of a waterproof layer. This system absorbs excess rainwater, improves air quality, and provides insulation for the structure.
Hydroelectric Power	A form of energy generated by converting the flow of water into electricity.
Insulation	A layer or barrier that minimizes the transfer of heat or cold from one material or location to another.
Kinetic Power	A form of energy generated by converting motion into electricity.
Renewable	A renewable resource can be replaced, replenished, or regenerated before its supply runs out.
Solar Power	A form of energy generated by converting sunlight into electricity.
Sustainable	Related to methods of using a resource so that it does not become depleted or permanently damaged.
Ventilation	The method of providing a building with fresh and clean air.
Wind Power	A form of energy generated by converting wind movement into electricity.

Additional Resources

Con Edison	www.coned.com/kids
Energy Kids	www.eia.gov/kids
EPA's K-12 Resource Page (Jan. 2017)	https://19january2017snapshot.epa.gov/students_.html
EPA's *The Greenhouse Effect* Video	https://www.youtube.com/watch?v=VYMjSule0Bw
Inhabitat Sustainable Design Blog	www.inhabitat.com/architecture
OneNYC	www1.nyc.gov/html/onenyc/visions/sustainability/goal-1-sustain.html
Sun Path Diagram App	http://andrewmarsh.com/apps/releases/sunpath3d.html
The Climate Reality Project	https://www.climaterealityproject.org
Urban Green Council	www.urbangreencouncil.org
US Green Building Council	www.usgbc.org

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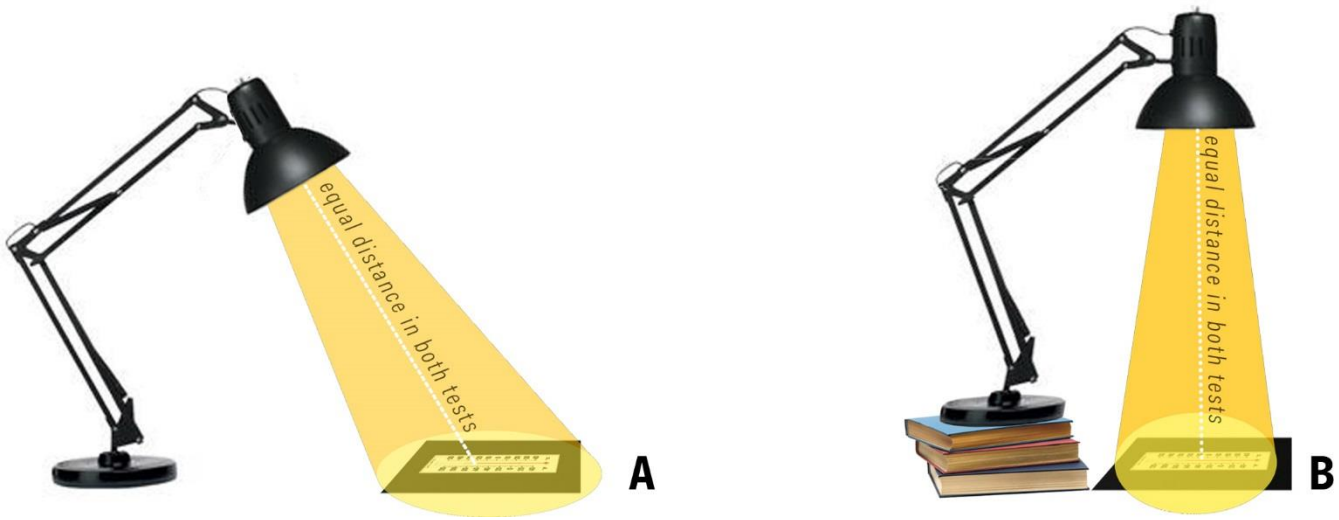
Direct and Indirect Light Experiment



Materials

Adjustable Lamp ▪ Tape Measure ▪ Thermometer ▪ Sheet of Black Paper ▪ Timer ▪ Stack of Books

Procedure

Step 1	Place the thermometer on the black sheet of paper.
Step 2	Set up Test A by adjusting the lamp so that it shines on the thermometer at an angle.
Step 3	Use a tape measure to measure the distance the light travels before hitting the thermometer.
Step 4	Turn on the lamp and record the temperature after 2 minutes of heating. Let cool and repeat 3 times.
Step 5	Set up test B by adjusting the lamp so that it shines directly above the thermometer with a 90° angle. Stack the books under the lamp to make sure the distance is the same as measured in test A.
Step 6	Turn on the lamp and record the temperature after 2 minutes of heating. Let cool and repeat 3 times.

Data

Test A	Trial 1: °F	Trial 2: °F	Trial 3: °F	Average: °F
Test B	Trial 1: °F	Trial 2: °F	Trial 3: °F	Average: °F

Question Your Results

1	Based on the data you collected, how does the angle of light affect temperature? How might this relate to our planet and the sun? Think about temperature based on location and season.
2	If heat is a measurement of energy, what is the most efficient angle to generate ***solar power***?

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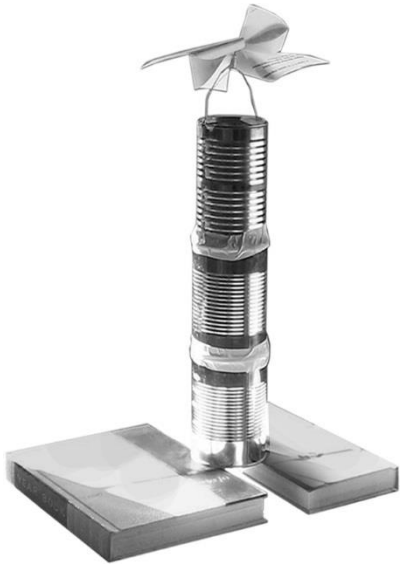
Solar Updraft Experiment

Materials

3 Cans with Top & Bottom Removed ▪ Tape ▪ Pinwheel Template (Page 6) ▪ Wire or Large Paperclip ▪ Thumbtack ▪ Two Books ▪ Direct Sunlight

Procedure



Step 1	Use tape to connect the 3 cans, forming one sealed chimney.
Step 2	Bend a wire arch and tape it to the top of your chimney at each side.
Step 3	Fold your pinwheel and puncture the center to be placed on the point of the thumbtack.
Step 4	Carefully tape the thumbtack in the center of the wire arch, with the point facing up. Place and balance the pinwheel on top.
Step 5	In an area with direct sunlight, place your chimney on top of two books, allowing air to enter at the bottom.
Step 6	Observe your pinwheel for the next 5 minutes.

Question Your Results

1 What do you think caused the pinwheel to turn? Where did this force come from?

_____

_____

_____

_____

2 How would you design a building to take advantage of this phenomenon for heating and cooling?

_____

_____

_____

_____

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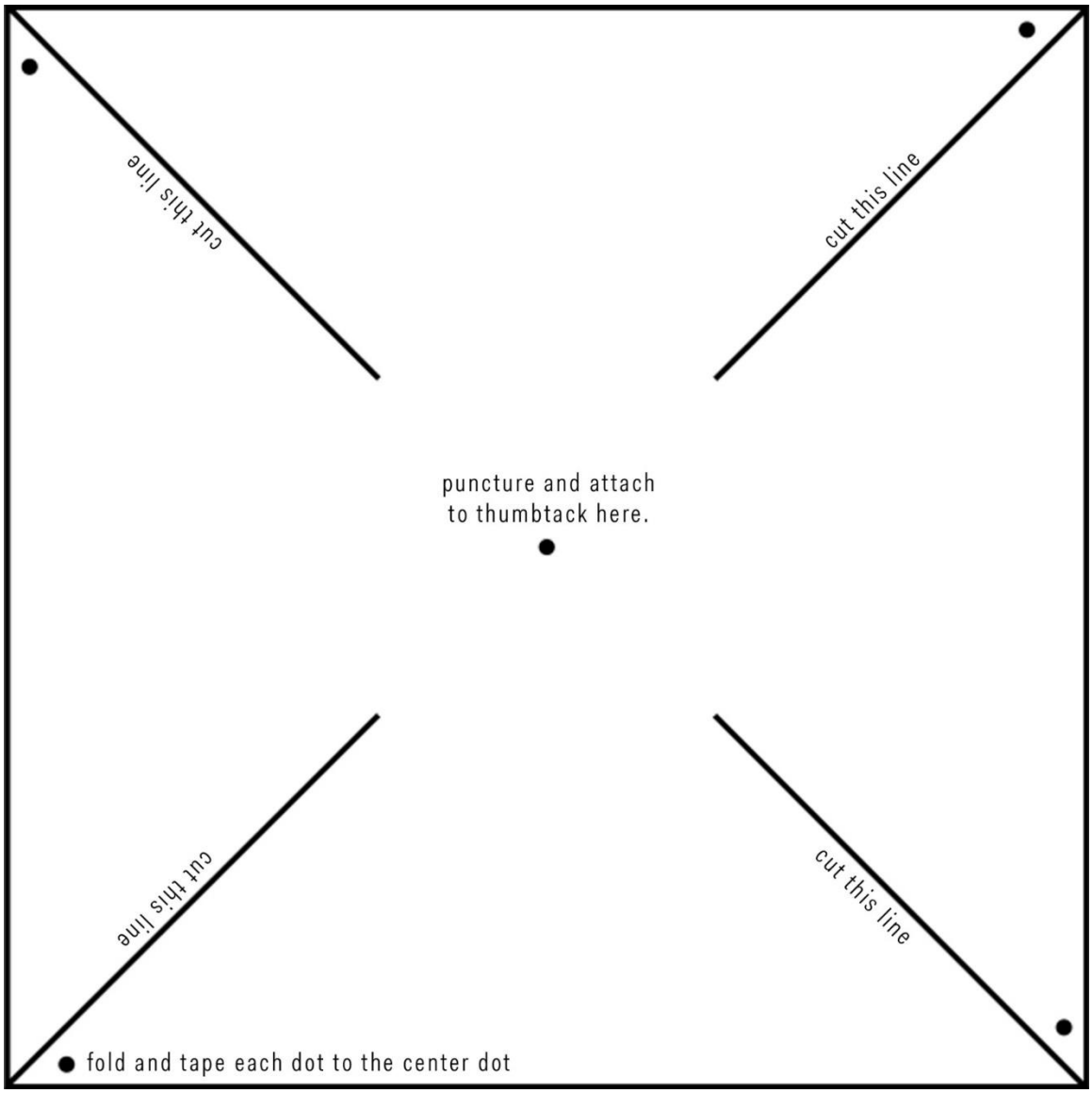
Solar Updraft Pinwheel Template

Assembly Instructions

Step 1	Cut out the square template.
Step 2	Cut the 4 diagonal lines.
Step 3	Fold and tape each corner by aligning the black dot from each edge to the black dot in the center.



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Student Day Curriculum Connections

New York State Learning Standards for the Arts: Learning Standards for the Arts at Three Levels		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
1	Creating, Performing and Participating in the Arts	■	■	■	■	■	■	■
2	Knowing and using Arts Materials and Resources	■	■	■	■	■	■	■
3	Responding to and Analyzing Works of Art	■	■	■	■			■
4	Understanding the Cultural Dimensions and Contributions of the Arts	■	■	■	■			■

NYC Blueprint For Teaching and Learning in Visual Arts: Five Strands of Art Learning		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
I.	Art Making	■	■	■	■	■	■	■
II.	Literacy in Visual Arts	■	■	■	■	■	■	■
III.	Making Connections	■	■	■	■	■	■	■
IV.	Community and Cultural Resources	■	■	■	■	■	■	■
V.	Careers and Lifelong Learning	■	■	■	■	■	■	■

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Common Core State Standards for Mathematics: Standards for Mathematical Practice		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
1	Make sense of problems and persevere in solving them.	■	■	■		■	■	■
2	Reason abstractly and quantitatively.					■	■	
3	Construct viable arguments and critique the reasoning of others.			■	■	■		
4	Model with mathematics.	■	■		■	■	■	■
5	Use appropriate tools strategically.	■				■	■	
6	Attend to precision.	■				■	■	

NYC K-5 Science Scope & Sequence + NYC 6-12 Science Scope & Sequence		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
K Unit 2	**Exploring Properties** How do we observe and describe objects and the physical properties of objects?				■			
Grade 1 Unit 2	**Properties of Matter** How do we describe the properties of matter?				■			
Grade 2 Unit 2	**Forces & Motion** What causes objects to move?	■						■
Grade 3 Unit 2	**Energy** How does the use of various forms of energy affect our world?			■				
Grade 3 Unit 3	**Simple Machines** How do simple machines help us in our daily lives?	■						■
Grade 6 Unit 4	**Interdependence** What factors affect the interdependence of living and nonliving things?			■				
Grade 7 Unit 2	**Energy & Matter** What materials are best to conserve and efficiently use energy?			■				
Grade 8 Unit 4	**Humans and the Environment: Needs and Tradeoffs** How can energy resources affect the future planning for the continuity of life on Earth?			■				

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New York State P-12 Science Learning Standards		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
DIMENSION 1: SCIENTIFIC AND ENGINEERING PRACTICES								
1	Asking questions (for science) and defining problems (for engineering)	■	■	■	■	■	■	■
2	Developing and using models	■	■	■	■	■	■	■
3	Planning and carrying out investigations	■	■	■	■	■	■	■
4	Analyzing and interpreting data	PV		PV		PV		
5	Using mathematics and computational thinking	PV		PV		■	■	
6	Constructing explanations (for science) and designing solutions (for engineering)	■	■	■		■	■	■
7	Engaging in argument from evidence	■		■				■
8	Obtaining, evaluating, and communicating information	■		■		■		
DIMENSION 2: CROSSCUTTING CONCEPTS								
1	Patterns	■	■	■	■			■
2	Cause and effect: Mechanism and explanation	■		■				■
3	Scale, proportion, and quantity	■	■	■	■	■	■	■
4	Systems and system models	■	■	■		■		■
5	Energy and matter: Flows, cycles, and conservation			■				
6	Structure and function	■	■	■	■	■	■	■
7	Stability and change	■	■	■				■

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New York State P-12 Science Learning Standards (continued)	Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
DIMENSION 3: DISCIPINARY CORE IDEAS							
Physical Sciences							
PS1.A Structure and Properties of Matter				■			
PS2.A Forces and Motion	■						■
PS2.C Stability and Instability in Physical Systems	■	■					■
PS3.A Definitions of Energy			■				
PS3.B Conservation of Energy and Energy Transfer			■				
PS3.D Energy in Chemical Processes and Everyday Life			■				
Life Sciences							
LS2.A Interdependent Relationships in Ecosystems			■				
LS2.C Ecosystem Dynamics, Functioning, and Resilience			■				
LS2.D Social Interactions and Group Behavior					■		
Earth & Space Sciences							
ESS1.B Earth and the Solar System			■				
ESS2.A Earth Materials and Systems			■				
ESS2.D Weather and Climate			■				
ESS3.A Natural Resources			■				
ESS3.B Natural Hazards							■
ESS3.C Human Impacts on Earth Systems			■				
ESS3.D Global Climate Change			■				

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New York State P-12 Science Learning Standards (continued)		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
DIMENSION 3: DISCIPINARY CORE IDEAS (continued)								
Engineering, Technology, and Applications of Science								
ETS1.A	Defining and Delimiting and Engineering Problem	■	■	■				■
ETS1.B	Developing Possible Solutions	■	■	■	■	■	■	■
ETS1.C	Optimizing the Design Solution		■	■	■	■	■	■
ETS2.A	Interdependence of Science, Engineering, and Technology	■	■	■	■	■	■	■
ETS2.B	Influence of Engineering, Technology, and Science on Society and the Natural World	■	■	■	■	■	■	■

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
COLLEGE AND CAREER READINESS ANCHOR STANDARDS FOR READING *								
1	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textural evidence when writing or speaking to support conclusions drawn from the text.	■		■	■		■	■
2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.			■	■			
7	Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.	■	■	■	■	■	■	■
COLLEGE AND CAREER READINESS ANCHOR STANDARDS FOR WRITING								
1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.				PV	PV		

**At the Center for Architecture, we consider visual representations (i.e., photos, drawings, models, etc.) to be texts with their own set of vocabulary. Through this lens, we practice "reading a building" to consider its design and purpose.*

PV These standards are met by completing the suggested extension activities found in the Student Day Resource Packet.

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Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects (continued)		Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
COLLEGE AND CAREER READINESS ANCHOR STANDARDS FOR WRITING (continued)								
2	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.			PV	PV	PV		
7	Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.	PV	PV	PV	PV	PV		PV
COLLEGE AND CAREER READINESS ANCHOR STANDARDS FOR SPEAKING AND LISTENING								
1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.	■	■	■	■	■	■	■
2	Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.	■	■	■	■	■	■	■
4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.					■		
5	Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.					■		
COLLEGE AND CAREER READINESS ANCHOR STANDARDS FOR LANGUAGE								
4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.	■	■	■	■	■		■
6	Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	■	■	■	■	■	■	■

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New York State K-8 Social Studies Framework: Social Studies Practices	Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
A **Gathering, Using, and Interpreting Evidence**	■		■	■			■
B **Chronological Reasoning and Causation**	■						■
C **Comparison and Contextualization**				■			
D **Geographic Reasoning**	■		■	■	■		■
F **Civic Participation**					■		

NYC K-8 Social Studies Scope & Sequence + NYC 9-12 Social Studies Scope & Sequence	Building Bridges	Geodesic Dome	Green Architecture	Language of Arch.	Neighborhood Design	Scale Model Building	Skyscrapers
K Unit 3 **Geography, People and the Environment** What makes a community?				■			
Grade 1 Unit 3 **The Community** What is a community?				■			
Grade 2 Unit 2 **New York City Over Time** How and why do communities change over time?	■						■
Grade 2 Unit 3 **Urban, Suburban and Rural Communities** How are communities the same and different?	■			■			■
Grade 8 Unit 2 **A Changing Society and the Progressive Era** How do people, policies and technological advances shape a nation?							■
Grade 10 Unit 6 **Globalization and the Changing Environment** Is globalization a force for progress and prosperity?			■				

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