

Nature-Inspired Homes

Learning Objectives

- Students will learn about biomimicry and see real-life examples.
- Students will explore nature- inspired characteristics and how they can be used in man-made objects and structures.

Activity Overview

- Students will use the Engineering Design Process to engineer a home inspired by nature.

Standards Addressed

- **SC.4.N.3.1** - Explain that models can be three dimensional, two dimensional, an explanation in your mind, or a computer model.
- **SC.4.P.10.4** – Describe how moving water and air are sources of energy and can be used to move things.
- **SC.5.P.13.1** - Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on a falling object.
- **SC.5.P.13.3** - Investigate and describe that the more mass an object has, the less effect a given force will have on the object’s motion.
- **SC.5.L.15.1** – Describe how, when the environment changes, differences between plants and animals allow some to survive and reproduce while others die or move to new locations.
- **SC.5.L.17.1** - Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycle variations, animal behaviors, and physical characteristics.

Materials

Item	Quantity Needed	Notes
Box fan	1	
Aluminum foil	2 rolls	
Spray bottle	1	
Construction paper	12 sheets	<i>Any color</i>
Scissors	10	<i>1 per group</i>
Masking tape	2 rolls	
Packing tape	1 roll	
Ruler	10	<i>1 per group</i>
Cardboard	10 sheets	<i>8"x8"</i>
Dixie cups	20	

Preparation

- Create group trays with the following: 1 ruler, 1 pair of scissors, 1 piece of masking tape (12 inches), 1 piece of packing tape (12 inches), 1 sheet of cardboard, 2 dixie cups, and 2 sheets of construction paper.
- Make a materials store with the other materials.
- Cut 2 sheets of construction paper into quarters, for testing.
- Fill the spray bottle with water.

Science Content

Biomimicry is a practice that learns from and mimics the strategies used by living organisms to solve challenges comparable to the ones we face as individuals and societies. The benefit is that nature presents us with many strategies far better at working harmoniously with the rest of nature than many human developed strategies have been. The goal then is to create products, processes, and systems that solve our greatest design challenges sustainably and in harmony with all life on earth.

The practice of biomimicry used these three elements:

Emulation: The attentive practice of learning from nature's forms and processes to guide human innovation and to create more regenerative design solutions.

Ethical Framework: A commitment to apply lessons learned from life's systems in a manner that creates conditions conducive to life, and a recognition that we have a responsibility to conserve and protect that which we are learning from.

(Re)connection: Acknowledgement that humans and our activities are not separate from nature, but are a part of nature, affecting and affected by all other organisms within Earth's interconnected systems. As a practice, reconnecting with nature encourages us to observe and spend time in nature to better understand how life works so that we may more effectively appreciate and emulate biological strategies in our designs.

Source: www.biomimicry.org

Facilitation Guide

Engage (10 minutes)

1. Tell the students the topic for the next few weeks is biomimicry: the design and production of materials, structures, and systems that are modeled on biological entities and processes.
2. Show some examples in the PowerPoint presentation.
3. Explain that they have been contracted by a local engineering firm. The firm has a client who would like them to design a home based upon or inspired by shelters created by animals.
4. Explain to students the goals of this activity:
 - a. Your model home must be inspired by at least one of the example animal shelters shown in the PowerPoint.
 - b. Your model home must be wind and water resistant.
 - c. Your model home must contain an entrance that allows a $\frac{1}{4}$ sheet of paper to be placed inside and taken out.
 - d. Your model home must be at least 12 cm tall and 12 cm wide.
5. To meet the goals of the challenge, explain that they will be using the Engineering Design Process (EDP). Briefly explain the steps of the EDP.
 - a. First, they will **ASK** questions about how to meet the goals: what materials they will use, how much time they have to build, and how they will test their designs.
 - b. Then, they will **IMAGINE** by exploring the materials and coming up with their own design in their head.
 - c. Next, students will **PLAN** by discussing their ideas and drawing out their first design on their worksheet. You must approve of their design before they build.
 - d. Once approved, students will **CREATE** their design using the materials and test it to see if they met their goal.
 - e. Finally, students will **IMPROVE** their design by discussing what they can change, drawing a new plan on their worksheet, rebuilding, and retesting.

Activity (35 minutes)

1. Have students get in groups of 3 or 4. Begin the Engineering Design Process with **ASK**: what do we need to know in order to meet the goals? Go over materials, time, how to test, etc.
2. Once questions have been answered, have students brainstorm and **IMAGINE** a design for their model home.
3. Have the students **PLAN** with their group to come up with one design for their model home. As groups are planning, ask:
 - Tell me about your design.
 - What materials will you use and why?
 - How will you meet the goals of the design challenge?
4. Once groups have planned their design, **ONE** student can gather a tray of materials and begin to **CREATE** their design. Circulate around the room to answer any questions and to check in with the groups.

- Has your design changed since planning with your group?
 - Do you think your design will meet the goals? How do you know?
5. To **TEST**, have each group bring up their home.
 - Measure the home's height and width.
 - Place home in front of the fan for 15 seconds.
 - Place a quarter sheet of construction paper inside the house. Spray the top of the house with water 15 times. Check the paper for water.
 6. Allow students 10 minutes to **IMPROVE** their design and retest.

Reflect (5 minutes)

1. Which animal shelter did you use to design your model home?
2. Did your design meet any of the goals?
3. How did you make your house waterproof?
4. How did you make it wind-resistant?