 

**ELEMENTARY SCHOOL**

**Sustainable Science**

**Animal Adaptations and**

**Engineering Design**

**Lesson 4: Building with Biomimicry**

**Teacher Background and Overview:**

Using biomimicry for ideas, scientists and engineers can create sustainable solutions for a vast range of problems. Scientists consider how plants and animals create a material or perform a process, and engineers then use that information to create inventions that are scalable to meet the needs of people.

The unit wraps up with the students utilizing the engineering design process to design a shelter that holds up to extreme weather conditions. Students will use the animal homes they researched in Lesson 3 for sources of inspiration as they design their shelter.

The following lesson is inspired by TeachEngineering.org’s“Biomimicry: Natural Designs”hands-on activity, available through this link:

<https://www.teachengineering.org/activities/view/cub_bio_lesson05_activity1>

**Time Required:**

30 minutes

30 minutes— *optional—*for student presentations

**Learning Objectives:** Students will…

* Gather information using various informational resources on possible solutions to a design problem.
* Design a solution that reduces the damage caused by weather to a shelter.
* Evaluate their shelter design prototype.

**Standards:**

***NGSS***

**3-5-ETS1-1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

**3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of a problem.

***Massachusetts Standards***

*STE*

**3.3-ESS3-1** Evaluate the merit of a design solution that reduces the damage caused by weather.

**3.3-LS4-3** Construct an argument with evidence that in a particular environment some organisms can survive well, some survive less well, and some cannot survive.

**3.3-5-ETSI-4(MA)** Gather information using various informational resources on possible solutions to a design problem.

*ELA & Literacy*

**RSIT.3.7** Use information gained from illustrations (e.g., where, when, why, and how key events occur) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

**WS.3.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

b. Develop the topic with facts, definitions, and details.

d. Provide a concluding statement or section.

**WS.3.8** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

**SL.3.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others’ ideas and expressing their own clearly.

**Materials:**

* Lesson 3 Student Worksheets
* Copies of Lesson 4 Student Worksheets
* Paper
* Rulers
* Markers
* Colored pencils

**Keys to Success:**

* Depending on your class, you may wish to allow students to choose their extreme weather condition, or you can assign the entire class the same weather condition.
* Though it is not written in the procedure, you may wish to have the students each write a paragraph about their shelter to explain their designs. This could then be used for assessment.

**Extension:**

* To extend the lesson, you may have teams share their designs with the class.

**Procedure:**

1. Review the engineering design process with the class. You may find it helpful to watch the following video, then discuss the Engineering Design Process Image:
   * *The Engineering Process: Crash Course Kids #12.2* (5-minute video) <https://www.youtube.com/watch?v=fxJWin195kU>
   * Engineering Design Process Image <https://p3cdn5static.sharpschool.com/UserFiles/Servers/Server_134329/Image/Pictures%20around%20CVE/Engineering%20Design%20Process.JPG>
2. Divide the class into teams of two students each. Pass out the completed Lesson 3 Student Worksheets.
3. Pass out the Lesson 4 Student Worksheets.
4. Ask each team to come up with a short list (3–5 things) that are important to think about when building a house and capture them in their worksheet (for example, waterproof roof, strong walls, cooling/heating, running water, etc.)
5. Ask students to compare and contrast the animal homes in their image sets with their partners and capture their thoughts on the Student Worksheet. Encourage them to ask questions about the animal environment, the shape of the shelters, how the shelters are held together, what the shelters are made from, etc.
6. Each team should have a scenario for an extreme climate or weather. The entire class may have the same scenario OR each team may choose/be randomly assigned a scenario.
7. Instruct each team to design a shelter—based off of their animal homes—that would effectively protect them and their family from the weather in their given scenario.
8. Pass out paper, rulers, markers, and colored pencils to the teams.
9. Teams should visually represent their design (sketch, graphic organizer, etc.) and describe its protective features with detail, including which parts were inspired by the animal shelters they referenced.

**Wrap-Up/Assessment:**

*OPTIONAL*: Wrap up by having student groups present their designs to the class.

1. Collect Lesson 3 and 4 Student Worksheets for assessment.

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***Building with Biomimicry: Lesson 4 Student Worksheet***

1. Name 5 things that are important to consider when building a house.

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1. What weather condition have you chosen/been assigned?

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1. Compare and contrast two of the shelters you chose in Lesson 3. Describe at least one similarity and one difference between them.

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1. On the back of this sheet, design a shelter—based off of your animal homes—that would effectively protect you and your family against the extreme weather condition you have chosen or been assigned. Describe how your shelter will protect its inhabitants, and explain how it was inspired.