



MOVING THROUGH SAND

Subject: Biomimicry

Grade Level: 5-8

Topic: Engineering Design Process

Time: 60 minutes

Learning Objectives

Students will:


- identify ways that animals move through sand.
- use the design process to build a vehicle that can move through sand using a biomimicry technique.
- use critical thinking to evaluate designs.

Materials

Animal Examples Sheet, Sand Vehicle Design Sheet, miscellaneous building material, cardboard, construction paper, pipe cleaners, buttons, paper cups, plastic caps, recycled egg cartons, yogurt cups, etc., tape, glue, highlighters, sticky notes, scissors, sand

Procedure

Engage: To promote student curiosity, have this discussion with students. *Ask: Have you ever walked on sand? Is it easy to walk on sand? Is all sand the same?* Have students share experiences. If possible, have sand on hand for students who have never walked on or played in sand. Share this video about the buoyancy of sand.

 Buoyancy of Sand demonstration-- Archimedes principle /// Homemade Science with Br... and discuss afterwards to be sure students understand what happened in the video.

Explore: Help students build an understanding by explaining to students that they will be creating vehicles that can move easily through sand. Inspiration for the vehicles will come from nature. Have students break into groups of 2-3 students. Each student will need a copy of the Animal Examples Sheet. The sheets provide information about how several different animals move on/through sand. Have groups read through the examples and highlight any ideas they think will be helpful when creating a vehicle that can travel through sand. If students have access to computers, they can explore additional ideas through an internet search.

Explain: Have students begin to show what they have learned by having each student share at least one idea on a sticky note that they learned about from their research. Once all notes are posted, have a class discussion where students can explain the pros/cons of the ideas they have collected. Group notes into categories to help organize ideas.

Elaborate: Have students use their new knowledge by working in groups using material provided to build a vehicle they think could successfully travel through sand. Students must use ideas they gained from their animal research in the construction of their vehicles. To make the activity more challenging, students will need to meet 2 building constraints: 1) the model needs to be no larger than 6" x 6" x 6" and 2) the model needs to have a feature that allows it to move through sand based on information gained from learning how real animals move through sand. After building the model, students will complete a written explanation of what they build and how it works. This information will be placed on the Sand Vehicle Design sheet.

Assessment

Evaluate: Evaluate student learning by having each group evaluate another group's model and read through the explanation of the design. They will decide if the group met the design constraints for this challenge. Builders will explain their ideas to their evaluators so they can decide if they think the technique will work. Offer suggestions for additions or improvements. Groups will discuss their ideas to decide if they think the technique will work. Offer suggestions for additions or improvements.

Extension Activities

- If possible, create a sand pit. Attach a string to vehicles and have students pull the vehicles through the sand to see how they travel.
- Have students research NASA's Glenn Research Center in Cleveland, Ohio which has a specialized lab called the **Simulated Lunar Operations (SLOPE) Laboratory**, which features large "sand pits" used to simulate the terrain of the Moon and Mars.

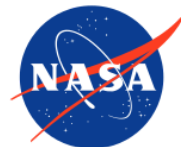
NGSS Alignment

Middle School

MS-ETS1-1 - Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.

MS-ETS1-2 - Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 - Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each.



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