

STEAM: Biomimicry and Energy

Grade Level:	Time Frame:
3rd Grade 4th Grade	50 Minutes
Standards (ALCOS Science):	
<p>From Molecules to Organisms: Structures and Processes: 10) Investigate how variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing (e.g., plants having larger thorns being less likely to be eaten by predators, animals having better camouflage coloration being more likely to survive and bear offspring).</p> <p>From Molecules to Organisms: Structures and Processes: 9) Examine evidence to support an argument that the internal and external structures of plants (e.g., thorns, leaves, stems, roots, colored petals, xylem, phloem) and animals (e.g., heart, stomach, lung, brain, skin) function to support survival, growth, behavior, and reproduction.</p>	
Objectives:	
<p>Students will compare and contrast how plants and animals have structural adaptations that help them survive and reproduce similar to ways that humans use technology to be able to sustain life on earth and support their species.</p> <p>Students will use their knowledge of plant and animal characteristics to create a design that uses technology and engineering to imitate characteristics found in nature.</p>	
Background Information:	
<p>Biomimicry is all around us, even if we do not notice it. "Bio" means life and "mimicry" means to imitate. So, biomimicry means to imitate life or nature. Biomimicry is a way of learning from nature. It is a way to observe nature in action and use that knowledge to inspire new ideas for new products like cars and toys and machines. Animals, plants, and fungi have unique ways of surviving and reproducing that can influence the technology we develop today. Furthermore, we might learn from nature how to live in a more compatible way with the earth and in a more sustainable way to leave a healthy earth for generations to come.</p> <p>As the world around us becomes more complex, the demand for products that will meet our needs becomes more defined. Scientists and engineers look to nature to learn more about how nature has already solved some of the issues humans face.</p>	
Materials:	

- FOR EACH PAIR OF STUDENTS:
 - printed file “(3rd-4th) Biomimicry Matching Cards”
 - do NOT print double-sided
 - cut each set of cards along dotted line
 - you could laminate these and use expo markers to write
 - small ziploc plastic baggie
 - mix each set of cards and place in baggie
 - pencils for writing on “Write it!” & “Draw it!” cards
- FOR EACH STUDENT:
 - printed file “(3rd-4th) Solar Engineering Design”
 - 10-15 squares of green construction paper or actual leaves cut into $\frac{1}{2}$ "x $\frac{1}{2}$ " squares
 - these will be referred to as “solar cells” during the activity
 - pencil for writing
 - colored pencils and markers
 - glue sticks

Engage (10 minutes):

1. **Think about it!** Teacher will write the words “bio” and “mimicry” on the board forming two columns.
2. Students will perform the “play or pass” game to describe the words using prior knowledge.
 - a. One student starts and answers/guesses one word that relates to either “bio” or “mimicry.”
 - b. If they aren’t ready to answer they can choose to “pass” but they have to stand up until all students have played.
 - c. All “passes” now “play” as they have received inspiration from their classmates.
3. Students will discuss the actual definition of the word “biomimicry” with guidance from the teacher. See “[Background Information:](#)” for more details.

Explore (20 minutes):

1. **Compare and Contrast!** Students will work in pairs to sort the “Biomimicry Matching Cards”.
2. Students should have 3 cards that include the categories “bio”(the living things), “mimicry” (non-living things that are imitating), and a description card.
3. They should match as many sets of 3’s as possible (total of 10 sets).
4. THEN, they must fill-in-the blank for the missing information on the “Write it!” and “Draw it!” cards.

Evaluate (20 minutes):

1. **Design it!** Students will express their knowledge by engineering their own solar powered product by drawing their design on the printed “Solar Engineering Design” sheet.
2. Like plants use the sun’s energy to use and store energy, students should use their “solar cells” (green construction paper or leaf squares), to portray in their design.
3. They will then describe how their design works by listing 2-3 sentences on the lines provided in the “How It Works” box.

Additional Content and References:

Websites to reinforce the plants/solar panels biomimicry:

Photosynthesis

<http://www.pbslearningmedia.org/resource/tdc02.sci.life.stru.photosynth/photosynthesis/>

- Stop at “plants make food inside their cells” to tell students that the role of the sun is coming up
- “The sun’s energy is stored in the glucose” like the sun’s energy is stored in a solar cell
- Show diagram of a solar cell and compare to leaf diagram

PDF lesson on Solar – pages 24-25. Read with students and emphasize that both leaves and solar panels “collect” energy from the sun

<http://www.need.org/files/curriculum/guides/Elementary%20Energy%20Infobook.pdf>

A more colorful diagram of how solar works (scroll down to diagram titled “How do solar cells work?”):

<http://www.explainthatstuff.com/solarcells.html>

A photo of solar panels and explanation that includes the concept of “cells”:

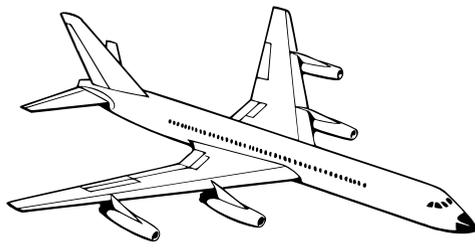
<http://www.highlightskids.com/science-questions/how-do-solar-panels-work>

NASA E-Clips - Plants in Space

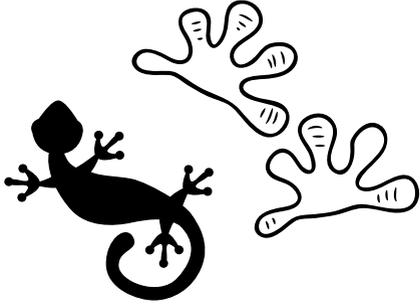
<https://nasaclips.arc.nasa.gov/playlists/ourworld?v=our-world-plants-in-space>

Solar Energy: It’s Importance to Earth and Space Exploration - A Digital Learning Network Experience Guide

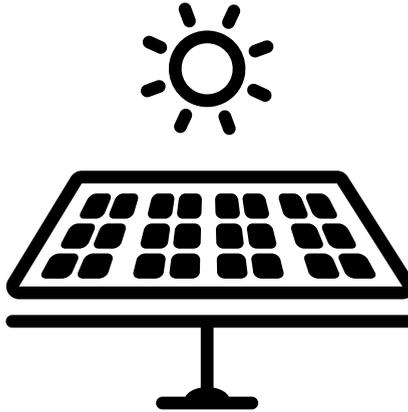
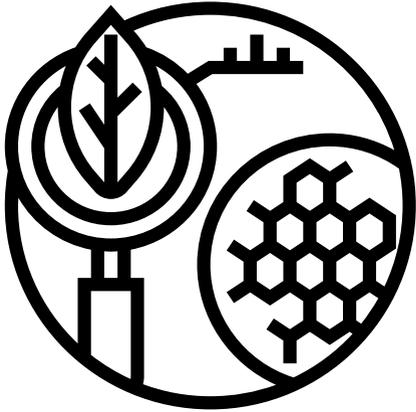
http://www.nasa.gov/pdf/469253main_Solar%20Energy%20K-4%20Educator%20Guide.pdf



Write it!



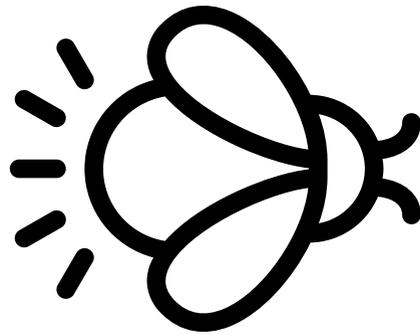
Write it!



Leaves of plants capture and store sunlight in their tiny cells. They can use the energy or store it for later use.

Solar panels use photovoltaic cells which can be used immediately by humans or stored in batteries for later use.

Draw it!



Fireflies are bioluminescent. Their blinking bodies help communicate their location and find a mate.

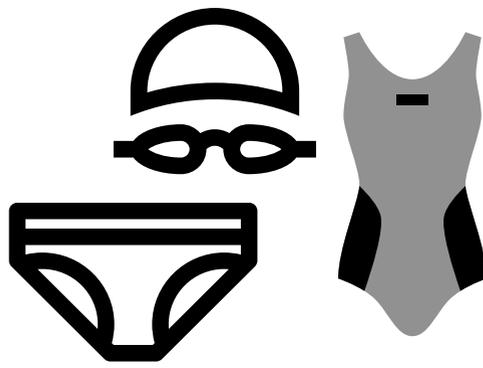
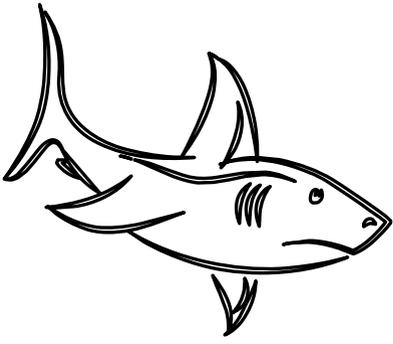
Airport towers have blinking lights that help communicate their location and planes navigate safely.

Draw it!

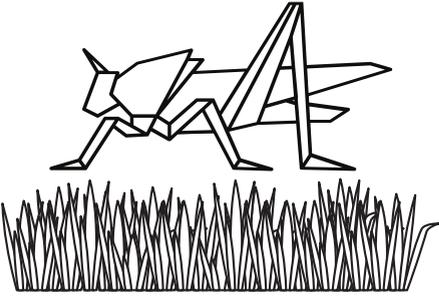


Seeds of maple trees are spread by air. They are called "whirligigs" because they spin and hover before reaching the ground.

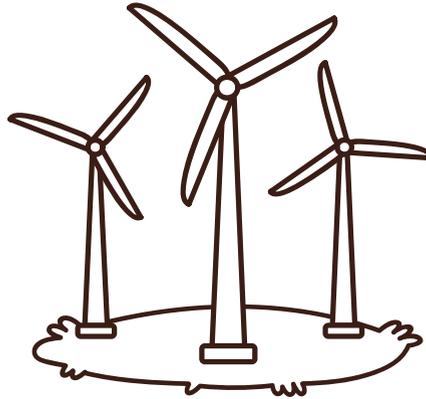
Helicopters can fly horizontally and vertically because of the special design of their rotating wings.



Write it!

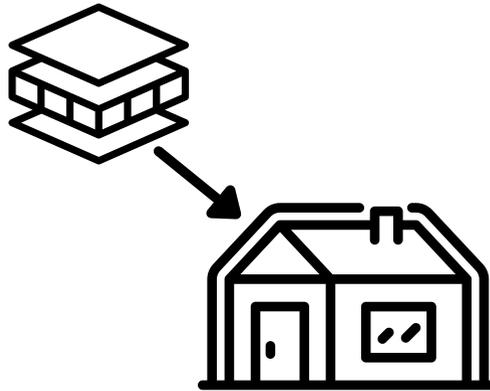


Write it!



Humpback whales have aerodynamic fins with special ridges to help them glide through the water.
Wind turbines have a similar design to help the blades glide smoothly through the air.

Draw it!



Polar bears have thick layers of fat, skin, and fur, along with special water-repellant hairs to keep them warm in cold temperatures.
Insulation in houses helps to reduce heat loss when you turn on the heater in winter.

Draw it!



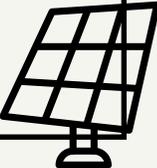
Lotus flowers have tiny projections on the surface of their petals which keep dirt and dust from collecting.
Some **household paints** produce a micro-rough surface that reduce the need to clean and dust walls.

Name of Engineer: _____



My Design

A large, empty rectangular box with a black border, intended for drawing or writing a design.



How It Works



Two horizontal lines within a rectangular box, intended for writing a description of how the design works.