

THE ARCTIC

OUR LAST GREAT WILDERNESS



Classroom Lesson

Animal Adaptions & Biomimicry

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Question:

What are the most important adaptations for a polar bear to have? The musk ox? What can humans learn from animal adaptations as they also live in the Arctic?

Animals have specialized features that help them survive in their habitat. The Arctic Wildlife Refuge has many species that call this special area home. The animals have specialized adaptations that allow them to live in this extreme environment. The polar bear has large paws that are used to distribute weight when walking on thin ice. In addition, the musk ox has a skull that is filled with air to prevent harm when butting heads while showing off. Many animals have specialized, fur and fat to insulate them from the cold.

Now it is your turn to create some projects based on the animal adaptations you have seen 🐾



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Vocabulary

- **Adaptation**
A specialized feature or behavior of an animal that allows it to live in its habitat
- **Habitat**
The area that an animal lives which includes its food sources, environment, and weather
- **Biomimicry engineering**
using animals and nature as a source for creating innovative designs

Standards

3-LS4-3 Biological Evolution: Unity and Diversity

3-5. Engineering Design

Background Information

Nature has long been the inspiration for human engineering and technology. The indigenous people of the Arctic observed polar bears walking and sliding on the ice using their big paws and bellies to distribute their weight. To mimic this design, the Arctic people invented snowshoes to spread their body weight out on snow and ice. In addition, they invented the toboggan to transport goods across the snowy landscape with a profile that is low to the ground. Biomimicry engineering involves designing modern technology with a sound foundation in the natural world. It does not look to incorporate nature into its design but to use the designs of nature. Examples include using bone structure to build walls of buildings, collecting water through fog catchers like the Namibian beetle, and using the Green Kingfisher as a model for bullet trains.

In the Arctic, scientists and engineers are collaborating with the Indigenous people to create naturally balanced solutions to problems of climate change such as sea ice thickness and the melting of the permafrost 🐾



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Activity: Examples of Biomimicry

Nature

Modern Engineering

The kingfisher's beak became the model for the nose cone of Japan's 500 Series Shinkansen bullet train.



The turbines for ocean wave energy capture now feature indentations like the whale flippers.



The polar bear foot is large to spread the weight of the bear on the ice. Like the Polar Bear foot, the snowshoe is designed to spread the weight of the user.



The Polar Bear slides on its belly to move on the polar ice blocks. The toboggan has a low center of gravity to spread the weight on the ice.



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Activity: Sliding Down the Ice

Background

Polar bears are easily identifiable by their white coats, long necks, and big paws. These characteristics allow the polar bear to spend considerable time on sea ice, where they hunt, rest, and eat. Navigating sea ice requires key adaptations that allow the bear to move without cracking the ice. One of these are large paws that allow the bear to grip and spread the weight and the other is a low center of gravity that spreads the weight in a wide area so that the ice remains intact 🐾

Materials

- Tray of water frozen into ice
- 2-liter bottle of soda
- Stack of Books about 1 ft high
- Random objects the students choose



Procedure

1. Talk about ice and how it is slippery and does not offer traction or grip
2. Tilt the ice tray on a stack of books to form an icy ramp



3. Slide the 2-Liter down the ramp. See if it falls over
4. Then slide the 2-Liter cap down the ramp. It stays on track because of the lower center of gravity
5. Next have the students choose an object to slide down the ramp
6. Make a hypothesis that it will remain upright or fall over
7. Slide down the ramp and verify if your hypothesis was correct or not

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Activity: Musk Ox Helmets

Background

Like the Polar bear, the musk ox has unique features to help it survive. One is a thick coat that provides extreme warmth in the cold arctic winters. The other is an air-cushioned skull to help in jousting or sparring for mates. The male musk ox's butt heads to prove who is the strongest and who gets to mate with the females 🐾



Challenge

Create a helmet like a musk ox skull to protect an egg that is launched from a catapult. **Hint** – the Musk ox skull has a cushion of air pocket in its skull to protect its brain 🐾

Materials

- 1 Egg
- Air filled materials to cushion the egg. (examples, bubble wrap, Styrofoam, sweaters, cotton ball)

Procedure

1. Sketch a design for a cushioned helmet for your egg. Label with the materials you plan to use and how you will attach the materials to the egg



2. Test your design without the egg to see if it holds together or if it needs improvement
3. Once you have a useful design, click your egg in the helmet with another egg like a musk ox
4. How did the egg hold up? Did the helmet work or need to be improved?

Engagement Questions to ask during

1. What types of materials will protect the egg?
2. What special adaptations does the musk ox have to protect its brain?
3. What other animals can you draw inspiration from to protect your egg?

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The Arctic in Your Backyard: Finding Animal Adaption in Nature

Background

Adaptations vary as the habitats the animals live in. What works in one environment does not work in others. In the Arctic, most animals are adapting to changing length of daylight, extreme weather, and harsh living conditions. How does your area compare to the arctic?

Let us look around your backyard, park or natural area to see if you can spot animal adaptations that may also come from the arctic 🐾

Activities to Try

1. Try going on a hunt to find adaptations using the pyramid
2. Pretend you are an arctic animal and dress in layers
3. Discover unique ways animals are adapted to your environment. Are they sleeping when its hot? Colored brown to blend in?
4. Can you find any articles around your house that are inspired by Arctic adaptations? Do you have gloves made of thick skin? Camouflage clothes? Layers on your bed?

