



Winter Seedheads - Activity 11: Nature First - Biomimicry

Over the years, humans have borrowed designs from nature to help with our own design challenges. This is called biomimicry. This activity allows the student to think critically about the functions of different structural characteristics, and to make connections between the natural world and their own.

Goals

- Identify the function of different structural characteristics
- Make connections between the natural world and their own
- Define biomimicry and provide examples
- Use scientific inquiry and research skills
- Use appropriate science technology and vocabulary
- Demonstrate an understanding of biodiversity

Material

- Biodiversity sheet

Activity

Nature designed it first! Many things in nature, such as winter seedheads, have special designs to help them function. Did you know that some of the inventions that we think humans invented already occur in nature? In fact, the study of this topic is called biomimicry. Biomimicry is a strategy where we look at nature to learn how to solve a human design challenge. Read the following list of "inventions" and see if you can find something on the biodiversity sheet that they relate to.

- Velcro
- Parachute
- Paper
- Axe or chisel

Extra Challenge:

After your students have figured out the nature-human connects below, have them do some research to answer the following questions. Alternatively, discuss the questions for them and use our answer sheet as a reference.

Velcro

1. What plant inspired the development of Velcro?
2. Who invented Velcro and how did he/she get the idea?
3. Make a list of products that use Velcro.

Parachute

1. What plants use parachutes?
2. Why do plants use them?
3. Do any animals use parachutes?
4. List different ways humans use parachutes.

Paper

1. What insects make paper?
2. How do insects make it?
3. What do insects use it for?
4. How do humans make paper?
5. List human uses for paper.

Axe or Chisel

1. What animals have special anatomy that works like an axe or chisel?
2. How do these animals use their special tools?
3. What simple machine is an axe or chisel?
4. How do humans use axes or chisels?





Nature First Challenge: Answers

Velcro

1. What plant inspired the development of Velcro?

Burdock inspired the development of Velcro. Burdock seeds are enclosed in a burr, which has tiny hooks to catch on the fur of passing animals in order to disperse the seeds away from the parent plant.

2. Who invented Velcro and how did he/she get the idea?

George de Mestral, a Swiss engineer, invented Velcro. In the 1940s, he got this idea after walking his dog and noticing burrs that were stuck to his pants and his dog's fur. He wondered how they attached and after looking at them under a microscope, saw that they had tiny hooks which would cling to the loops of fur and fabric. This led to the invention of Velcro loop and hook fasteners.

3. Make a list of products that use Velcro.

Answers may vary. Products that use velcro include shoes, coats and jackets, baseball caps, medical bandages, backpacks, notebooks, pants pockets, diapers, etc.

Parachute

5. What plants use parachutes?

Answers may vary. Plants that use parachutes include goldenrod, yarrow, aster, milkweed, Virgin's Bower, knapweed, and cattail. The seeds of all these plants have silky filaments that help them to catch the wind.

6. Why do plants use them?

Plants use parachutes to help disperse their seeds. As the seeds detach from the parent plant, hair-like filaments or winged structures attached to the seeds act as a parachute to catch the wind and carry them farther away from the parent plant. This allows the plant to spread and grow in new locations.

7. Do any animals use parachutes?

Gliding animals and spiders also use parachutes to travel over long distances. Flying squirrels have a loose fold of skin that stretches between their front and hind legs, and this acts as a parachute to glide for distances of 20 metres or more. Spiders can release silk strands into the air to catch the wind and move through the air in a process called ballooning.

8. List different ways humans use parachutes.

Answers may vary. Humans use parachutes for skydiving, parasailing, to safely drop packages from planes, to slow down capsules returning to Earth from space, to create more resistance in speed training, to slow down in drag racing, etc.

Paper

6. What insects make paper?

Answers may vary. Insects that make paper include the Paper Wasp, Bald-faced Hornet, and Yellow Jacket.

7. How do insects make it?

Insects such as wasps make paper by using their mandibles to scrape off wood fibres from trees, logs, fences, and even cardboard, and mixing it with saliva to create a soft paper pulp. This paper pulp will dry into a tough, papery material.

8. What do insects use it for?

Insects such as wasps will use the paper to create a nest to live in, store food, and raise young. After mixing wood fibres and saliva in their mouths, wasps will deposit their mouthful of paper pulp into hexagonal cells and layers of material, which will dry to form a sturdy paper nest that we can see on trees and sometimes human structures.

9. How do humans make paper?

Humans make paper by extracting plant fibres from a variety of sources, usually the portions of trees that are undesirable for construction, and turning it into paper pulp by breaking it down in a machine, with heat, and with chemicals. The pulp is then combined with water and placed into a paper-making machine where it is flattened, dried, and cut into sheets.

10. List human uses for paper.

Answers may vary. Humans use paper for printing and writing, packaging, decorating, paper money and other currency, cleaning, construction such as wallpaper, scientific processes such as indicator papers, etc.

Axe or Chisel

5. What animals have special anatomy that works like an axe or chisel?

Answers may vary. Woodpeckers have a beak and rodents have teeth that work as an axe or chisel.

6. How do these animals use their special tools?

Answers may vary. Woodpeckers use their strong beaks to chop into trees to make secure homes to raise young and to find insects living underneath the bark to eat. Rodents have large,

chisel-like incisors that are used for many different purposes, such as cutting through wood, gnawing into nuts and other foods, burrowing, and defense.

7. What simple machine is an axe or chisel?

An axe or chisel is a wedge.

8. How do humans use axes or chisels?

Answers may vary. Humans use axes or chisels for cutting or cutting hard materials like wood, stone, or metal; as a weapon; and for recreational activities like axe throwing.