BEAVER ADAPTATIONS

FOURTH GRADE TEACHER GUIDE

Ecology in Classrooms & Outdoors

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BEAVER ADAPTATIONS
UNIT OVERVIEW

SUMMARY

In this unit, students will dive into the study of animal adaptations, focusing on the American beaver. Each activity reinforces nine physical adaptations American beaver adaptations that make it uniquely suited to its wetland habitat: strong teeth, broad tail, nictitating membrane, nose and ear flap, thick fur, waterproofing oil, split nail, webbed feet, and strong front nails. Students will play the engaging Beaver LODGE-ic board game, sort descriptive and explanatory beaver facts, and create a new product using the concept of biomimicry to understand the important role the American beaver plays in wetlands across the Pacific Northwest.

OVERALL GUIDING QUESTION

What adaptations do beavers have and what are their functions to support beavers' survival?

OBJECTIVES

Each student will be able to:

- Define, explain, and communicate information about the American beaver and its physical and behavioral adaptations
- Develop an understanding of the role of the American beaver in Pacific Northwest habitats such as wetlands, forests, meadows, and river systems

USING THIS GUIDE

The ECO Beaver Adaptations Unit incorporates four interdisciplinary lessons to fully explore beaver adaptations and engage students across English language arts, social science, and art. It is necessary to present the science lesson before the additional lessons to lay the foundation of understanding. ECO has created a recommended order beyond the science lesson, but teachers are free to modify the sequence.

Each lesson offers suggestions for a closing circle, discussions, or journal prompts. These suggestions may be used anytime throughout the unit as an assessment to monitor student progress.

Each Place-Based Unit has been intentionally designed to consider Diversity, Equity, and Inclusion in every classroom.

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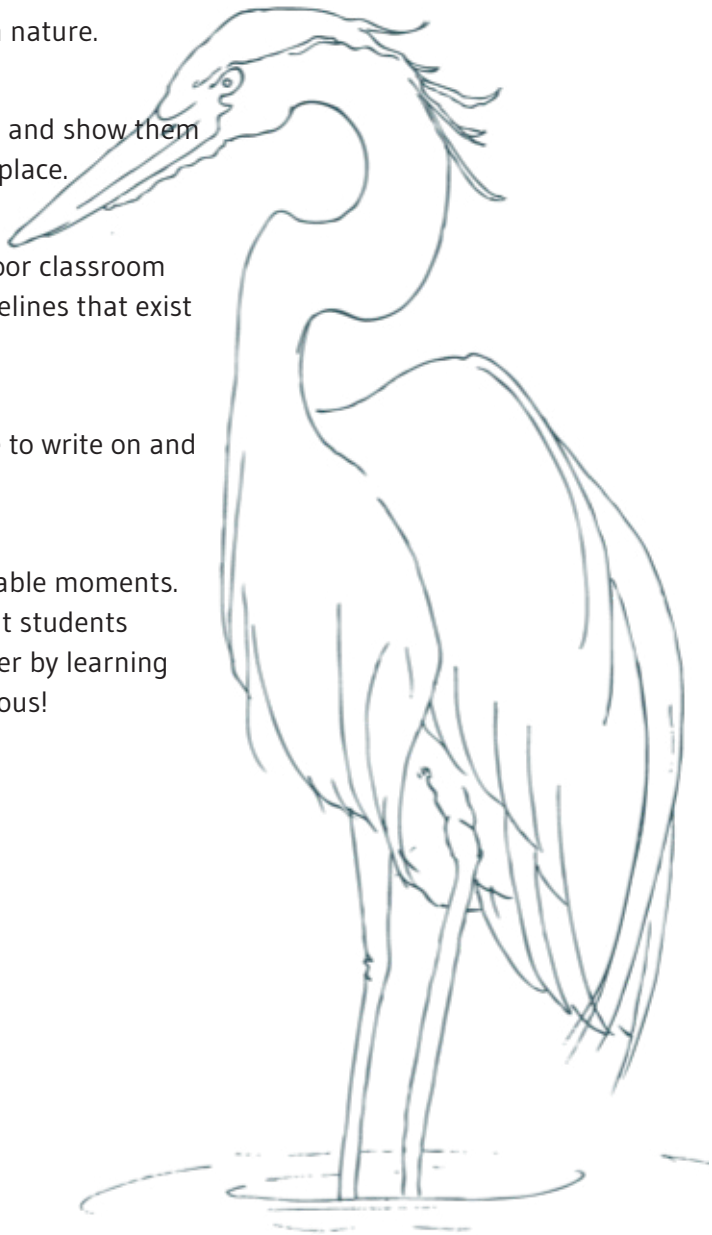
BEAVER ADAPTATIONS

UNIT OVERVIEW

WANT TO TAKE THE LEARNING OUTSIDE?

This unit is designed to be delivered indoors or outdoors! We encourage teachers to find spaces in the schoolyard where students are able to learn and interact directly with nature.

- Take students on a walk around the schoolyard and show them the outdoor classroom before the lesson takes place.
- List expectations and boundaries for your outdoor classroom so that students remember that the same guidelines that exist inside, exist outdoors.
- Make sure to bring clipboards or a hard surface to write on and have students wear appropriate clothing.
- Remember, outdoor learning is all about teachable moments. Encourage curiosity, pause for observations that students are excited about, and nurture a sense of wonder by learning alongside your students. Enthusiasm is contagious!



SUPPORT

Please contact **support@ecologyoutdoors.org** with any questions or concerns.

TRAINING

Videos of ECO educators delivering select sections of the lessons are available. Contact **support@ecologyoutdoors.org** for access.

BEAVER ADAPTATIONS

STANDARDS OVERVIEW

SCIENCE (NGSS)

- 4-LS1-1 From Molecules to Organisms: Structures and Processes
  Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

MATH

- 4.OA 2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.
- 4.MD Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. 1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table.

ELA

- 4.RL.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- 4.L.4a Use context as a clue to the meaning of a word or phrase.
- 4.W.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

ART

- MA.2.CR2.4 Discuss, test, and assemble ideas, plans, and models for media arts productions, considering the artistic goals and the presentation.
- MA.10.CO1.4 Examine and use personal and external resources, such as interests, research, and cultural understanding, to create media artworks.

BEAVER ADAPTATIONS BACKGROUND

The American beaver (*castor canadensis*) is a mammal, and the largest rodent in North America. They can be found throughout North America, with the exception of the northernmost parts of Canada and the deserts of the American Southwest. Beavers live in habitats where they can find sufficient food sources, which include wetland plants such as lilies, cattails, and duckweed, as well as woody shrubs and trees such as willow, aspen, cottonwood, beech, birch, dogwood, and alder. They use these woodier shrubs and trees to build their dams, which block the flow of a creek, stream, or even a river. This creates pools of slow-moving water, like a pond or a wetland. They need slow-moving water to build their **lodges** that keep them safe from predators and provide a place to store food for the winter.

American beavers are remarkable creatures with extremely unique **characteristics**, which make them a great example to study **adaptations**, or traits that make animals particularly suited to their environment.

In this unit, there are two ways students will think about adaptations: **physical** and **behavioral**. **Physical adaptations** present as a body part or function to help the organism survive. **Behavioral adaptations** present as activities or social structures to help the organism survive; for example, beavers are social and protect one another by slapping their tail on the water to warn others that predators are nearby

WHY STUDY BEAVERS?

Historically, the American beaver has played a key role in ecosystems of the Pacific Northwest. By understanding how the beaver has adapted to habitat conditions, students will gain a greater understanding of this animal and an appreciation for its role in the ecosystem. By recognizing why animals have physical and behavioral adaptations, students will be able to apply this knowledge to other animal species and make linkages between animal traits and habitat conditions.

Beavers are an important species to understand, monitor, and protect, due to their critical impact on waterways and landscapes. It is now widely understood by scientists that beavers and beaver activity will play an integral role in mitigating the harsh impacts of a changing climate. They will do this by keeping water levels and flooding under control, maintaining slow-moving ponds and wetlands for water retention and holding sediment, keeping water temperatures cooler, cultivating plant growth to take in greenhouse gases, and reducing the severity and the spread of wildfires.

ACADEMIC VOCABULARY

lodge
characteristic
adaptation
physical adaptation
behavioral adaptation

SCIENCE LESSON

BEAVER ADAPTATIONS

SUMMARY

In this lesson, students use costume pieces to represent the American beaver's physical and behavioral adaptations that help them to survive in the Pacific Northwest. Students learn about characteristics such as teeth, fur, oil glands, and others in order to understand that an animal's physical characteristics are adaptations that aid them in survival, growth, behavior, and reproduction. Then, students test their new knowledge by drawing a beaver and labeling the adaptations and their functions.

OBJECTIVES

By the end of the lesson, students will be able to:

- Define the terms characteristic and adaptation as they pertain to animals
- Describe nine adaptations that American beavers have that help them survive

GUIDING QUESTIONS

1. What physical and behavioral adaptations do beavers have?
2. How do these adaptations support beavers' survival?

LESSON-AT-A-GLANCE

GRADE LEVEL 4

INTEGRATED LEARNING FOCUS Science

LESSON DURATION 20 - 30 minutes

CLASS SIZE Any

ACTIVITY TEAMS Groups of 3 - 4

MATERIALS

- Presentation *Beaver Adaptations*
- Clay teeth
- Clip on tail
- Goggles
- Clothes-pin
- Earmuffs
- Fur coat/vest
- Olive oil in container
- Comb
- Flippers
- Gloves with nails
- Paper
- Pencils and colored pencils, crayons, or markers

NGSS

- 4-LS1-1 From Molecules to Organisms: Structures and Processes.

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

ACADEMIC VOCABULARY

aquatic	**model**
herbivore	**adaptation**
lodge	**physical adaptation**
characteristic	**behavioral adaptation**

ACTIVITY PROCEDURE

1. PREPARE THE ACTIVITY

Check the unit contents to make sure all the costume pieces are accounted for, and set aside for later.

Have students clear their desks other than a piece of paper and a pencil, which will be used for the end of the lesson.

Set up the presentation titled *Beaver Adaptations*.

2. UNDERSTANDING BEAVER ADAPTATIONS

Explain to students that they will be studying a very important and interesting animal that lives in the Pacific Northwest. You may give students hints for them to guess: it builds dams, it is the largest rodent in North America, it is known for having sharp teeth and a flat tail… the beaver!

Ask: What kind of habitat does a beaver live in?
Beavers are **aquatic herbivores**, meaning they live their lives mostly in or around the water and they eat plants. They build dams to block the flow of a creek, stream, or even a river. This creates pools of slow-moving water, like a pond or a wetland. Beavers need slow-moving water to build their **lodges** (homes) that keep them safe from predators and provide a place to store food for the winter. By slowing the flow of waters, beavers are also creating more habitat for their preferred food sources (trees, shrubs, and other water-loving plants). Tell students that the beavers that live in the Pacific Northwest are well-adapted to living in wet and cold habitats.

Tell students that in order to understand the beaver and its role in the ecosystem, they will be creating a **model** of a beaver using various costume items to represent the beaver's characteristics. Remind students that in science, a model is a representation of an idea, process, system, or object.

Ask: What is a characteristic or trait? Does anyone have an example of a characteristic or trait?
Have students input their own ideas as to what they think a **characteristic** is. Then, give them the definition: "A distinguishing quality, trait or feature of an individual, thing, disorder, etc."[1] In other words, a characteristic is something you can observe about a plant or animal, such as the shape of a leaf or the color of an animal's fur.

Ask: What is adaptation?
In ecology, adaptation is "The adjustment or changes in behavior, physiology, and structure of an organism to become more suited to an environment; the state reached by the biological population undergoing adjustments or changes."[2] In other words, adaptations are changes that happen to an organism over time to help it survive in its environment.

These adaptations or changes may be physical (also called structural), behavioral, or physiological (occurring on the inside of the body). In this unit, students will be focusing on physical adaptations and behavioral adaptations. **Physical adaptations** present as a body part or function to help the organism survive. For example, the beaver's thick fur is a physical adaptation. **Behavioral adaptations** present as activities or social structures to help the organism survive; for example, beavers are social and protect one another by slapping their tail on the water to warn others that predators are nearby.

3. BUILD A BEAVER

Ask for a student volunteer who feels comfortable putting on costume items to become a beaver "model" to help the class learn about beaver adaptations. Invite the student to be a bit silly (after all, it is a game of dress-up!), while maintaining appropriate classroom behavior. Encourage them to "swim" around the classroom to show off their beaver attire.

Alternative for homeschool or distance learning:
Have students consider each adaptation and its function, then find items in their households to represent each trait and build their own beaver. Bonus points for up-cycling materials that would otherwise be thrown out! Encourage students to take a photo of them in their beaver "costume" and share with the class.

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[1] https://www.biology-online.org/dictionary/Characteristic
[2] https://www.biology-online.org/dictionary/Adaptation

Go through each costume item, asking questions along the way to get students to think about the function of each characteristic.

- Teeth: cut-outs
  Teeth are used to scrape nutritious bark from trees and shrubs, and cut tree parts to use for dams. Beavers teeth continue to grow throughout their lives, like our fingernails. Gnawing or chewing on wood helps to file their teeth down and keeps them sharp.

- Tail: cut-out attached to belt
  The beaver tail helps beavers swim, it can be slapped on the water to warn their family of predators, and it also stores fat that can be used for energy when food is scarce.

- Nictitating membrane: goggles
  Beavers spend a lot of time in the water, and their 'clear eyelid' protects their eyeballs from water and dirt and helps them to see while swimming.

- Nose/ear flap: clothespin and ear muffs
  Similar to their extra eyelid, there is a flap on their nose and in each ear that closes when they go under water. (Beavers also have a lip behind their teeth so they can chew and carry things in their mouth underwater without getting water in their mouth).

- Fur: furry/fuzzy coat
  Beaver's fur coats are thick to keep them warm even in cold water. There is a layer of longer hair to keep water away from their body, and a layer of soft, downy hair that keeps them warm (also known as insulation).

- Oil: olive oil
  (in a bottle; student may mime putting the oil on their fur and around their lodge) Beavers make a special oil that they use to cover their fur in order to waterproof the fur and keep them extra warm. The oil has a strong musky odor and they sometimes put the oil on their homes and around their ponds to let other beavers know it's their territory.

- Split nail: comb
  To help the beavers spread the oil over their fur, their feet have split nails. The nails split into two parts like a little comb which makes it easier for them to cover their fur in oil.

- Webbed feet: flippers
  Remember, beavers spend most of their time in the water. In addition to their tail, their back feet are webbed to help them swim faster and stronger.

- Nails: gloves with nails
  Beavers have tough nails on their front feet which help them dig in the mud. Their paws are a lot like hands and they use them to put mud into place on their dams and lodges.

5. DRAW AND LABEL

Now that students have seen physical examples, invite them to find their own space to draw and label a picture of a beaver in its environment.

Students should draw their beaver with at least five adaptations labeled with the function underneath. For example, students might label "Teeth: helps to cut down trees for food and for building materials."

CLOSING CIRCLE

Have students color in their illustration and add more details depicting the beaver's habitat, then share their illustration with a partner or to the whole class.

ASSESSMENT OPTIONS

Use students' labeled drawings to assess learning.

MATH LESSON

BEAVER LODGE-IC BOARD GAME

SUMMARY

In this lesson, students work together to solve equations and make their way through a board game set in a beaver's Pacific Northwest wetland habitat. To get through the game, all students' beaver pieces must make their way to the center of the pond to safety. In order to advance, students will learn facts about beavers and must solve mathematical conversions about these facts, recording them in a two-column table. Along the way, beavers will encounter predators, environmental challenges, and other obstacles that may set them back - but not for long, since beavers have many amazing physical and behavioral adaptations to help them survive!

LESSON-AT-A-GLANCE

GRADE LEVEL 4
INTEGRATED LEARNING FOCUS Math
LESSON DURATION 30 - 60 minutes
CLASS SIZE Up to 30
ACTIVITY TEAMS Groups of 3 - 5
CLASS

MATERIALS

- (6 sets) Beaver LODGE-ic board game:
  - Game board
  - Set of Conversion Cards & Obstacle cards (33 total)
  - Beaver pawns (5)
  - Conversion Card Solutions Tables (5)
  - Dry-erase markers (5)
- Conversion Card Answer Key

OBJECTIVES

By the end of the lesson, students will be able to:

- Solve various conversions involving measurement and conversion of measurements from larger to smaller (or smaller to larger) units, quantifying beaver traits and other facts about beavers
- Demonstrate ability to work in a team to accomplish the goal of the game

GUIDING QUESTIONS

1. What adaptations (physical or behavioral) do beavers have that help them to survive and how are they measured?

2. How do beavers interact with their habitat, and what challenges do they face?

MATH

- 4.OA 2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.
- 4.MD Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. 1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table.

ACADEMIC VOCABULARY

data
conversion
unit
tool
conversion formula

ACTIVITY PROCEDURE

1. PREPARE THE ACTIVITY

Ensure each Beaver Lodge-ic container has all of the required pieces: beaver pawns, the board, conversion card solutions tables, and the draw cards. Create student groups of 3-5 for when it's time to play the board game.

2. REVIEW BEAVER ADAPTATIONS

Ask: From our science lesson, what adaptations do beavers have to help them survive?
Encourage students to make educated guesses. Share that an apple typically has 5 seed pockets with 1 or 2 seeds in each pocket, depending on the health of the tree.

Ask: How do ecologists - scientists who study the relationships and connections within natural systems - communicate their findings?
Ecologists are experts at observation, but they must be sure to record their findings (called **data**) and communicate them with others. To record data, an ecologist may take measurements to get a better understanding of how to identify the animal they are studying, or record how the animal behaves in its habitat. They then take that data and communicate it in many different ways, depending on the audience. Frequently, scientists will publish their findings in a scientific journal or if they want a broader audience to access their findings, they might use graphs, charts, or diagrams.

Ask: Why is it important to have a basic understanding of how an animal looks and behaves in order to conserve/preserve or restore habitat for that particular animal?
Simply put, we cannot protect what we do not understand! By understanding things such as average body size, average number of offspring and how frequently an animal gives birth, average lifespan, minimum amount of resources needed to survive, etc., scientists will notice when there is something going wrong in the system if data are out of the ordinary.

Explain to students they will play a board game in which their challenge will be to solve conversions using interesting facts from data about beavers.

3. WHAT IS A MATHEMATICAL CONVERSION?

Ask: What do you already know about conversions? For example, if you measured your desk in feet, what would it mean to convert it to inches?

- **Conversion**, in math, is the change of the unit measurement, without a change in the size or amount of the measured object. If you measure your desk, it is not getting larger or smaller, yet you may record it in inches (smaller unit) or feet (larger unit).
- A **unit** is what is used to measure an object, and is associated with the **tool** used to measure it.
- Example: the length is measured in inches using a ruler and weight is measured in pounds using a scale.

Ask: How do you convert between two different units?
Explain that in order to convert between two units, they will need to know the **conversion formula**, which tells the problem solver what to multiply or divide by to make their conversion.

The conversion formulas students will use in this activity are:

1 foot = 12 inches; 1 inch = 1/12 foot

1 mile = 5,280 feet; 1 foot = 1/5280 miles

1 year = 12 months; 1 month = 1/12 year

1 year = 365 days; 1 day = 1/365 year

1 minute = 60 seconds; 1 second = 1/60 minute

1 pound = 16 ounces; 1 ounce = 1/16 pound

Using some of the above conversions, show a few examples on the board, having students practice multiplying or dividing to get the proper unit measurement. See below for some examples, or you may write your own.

$$3\ years \times \frac{365\ days}{1\ year} = 1095\ days$$

How many minutes are there in 2520 seconds?

$$2520\ seconds \times \frac{1\ minute}{60\ seconds} = 42\ minutes$$

Which is longer: 42245 ft or 8 miles?

$$42245\ feet \times \frac{1\ mile}{5280\ feet} = 8\frac{1}{1056} miles\ so\ 42245\ feet > 8\ miles$$

OR

$$8\ miles \times \frac{5280\ feet}{1\ miles} = 42240\ feet\ so\ 42245\ feet > 8\ miles$$

4. HOW TO PLAY BEAVER LODGE-IC

Tell students that they will be working in small groups to play a board game set in a beaver habitat, modeled after an ecosystem one may find here in the Pacific Northwest. Their goal is to get ALL the beavers to the lodge in the center of the pond.

Tip: If your class has visited a wetland before, or you know of a wetland nearby, compare the game to the site they've visited in real life, and draw connections between the two. There may be some similarities!

Set up the game by having groups of 3-5 students set out their game board on a table, select their beaver pawn, shuffle the deck of cards together and place them on the table, and give each player a laminated table worksheet and dry-erase marker. Give teams scrap paper and pencils for solving problems.

Begin the game by having players select a starting point for their beaver, indicated by the word "start" on the edges of the game board. More than one player may start on the same starting location, if there are more players than starting points. Have players select who will go first based on their birth month, by guessing a number, drawing numbers from a hat, etc. The first player will select a card from the deck to determine their first move, and then players will select cards going clockwise. If the first card drawn is an obstacle card, it should be randomly placed back in the deck and the first player should draw until they get a conversion card.

Game play:

Conversion Cards

- If the card is a conversion card, the player may choose to **solve the problem on their own**, and advance their beaver equal to the amount of players in the game. For example:
  - If there are 3 players, they move 3 spaces.
  - If there are 4 players, they move 4 spaces.
  - If there are 5 players, they move 5 spaces.
- OR the players may **solve the problem as a team**, and advance all of the beavers forward one space. The player must read the problem out loud, and all players must record their solutions in their two-column table using fractions (they may also include the decimal equivalent in addition to the fraction form).
- Players can then check their work using the answer key by comparing the number in the lower right hand corner of each conversion card to the corresponding line in the answer key. For example, if a player solves conversion card number 12, that player would look for the answer to number 12 on the answer key.

Example: American beavers' tails help them swim and can grow to be 14 inches long. How many feet is that?

Given Units	Conversion
14 inches	1 ⅙ feet (or 1.17)

Obstacle Cards

- If the card is an obstacle card, the player must **read the card out loud to the group**, and the group must discuss the question on the card before the next player's turn.
- Each player must move their beaver pawn back one space, unless their beaver has already made it safely to the pond.

General Game Play

- Players may use the mudslides as a shortcut if and only if their beaver lands on the space at the entrance of the mudslide. Spaces to move to and from are indicated with brown dots.
- Once a player reaches the pond, they continue drawing cards, but instead of moving their own beaver forward, they can gift their movement to another player. If a player in the pond draws an obstacle card, they simply ignore it and the game proceeds to the next player.
- If the draw pile runs out, shuffle the discard pile and continue playing.
- The game is finished when all players' beavers are safe in the pond.

5. REVIEW ANSWERS AND OBSTACLES

As a class, check the answers to the conversion problems by going through the answer key out loud. Stop at problems that many students got wrong, and go over them as a class on the board.

Select a handful of obstacle cards and invite students to share what their group discussed when they received the card.

Have each group of students clean up their game, erase their conversion solutions tables, and make sure all pieces are put back neatly.

ASSESSMENT OPTIONS

Checking answers as a group gives students the opportunity to correct mistakes and practice each problem again, while giving you a sense of which students may be struggling with setting up the equation, multiplication, or division.

ELA LESSON

EXPLANATION OR DESCRIPTION?

SUMMARY

In this lesson, students use their knowledge of beaver adaptations to sort sentence cards into categories of explanations and descriptions. After discussing the differences between explanatory and descriptive language, students participate in a hands-on activity that gets them reading, sorting, and writing about how beavers and other animals have certain traits (body parts or behaviors) that help them survive in their native habitat.

OBJECTIVES

By the end of the lesson, students will be able to:

- Sort sentences into categories of explanation and description.
- Use sentences to explain how beavers have specific traits that help them survive.

GUIDING QUESTION

1. How is a descriptive sentence different from an explanatory sentence?

LESSON-AT-A-GLANCE

GRADE LEVEL 4

INTEGRATED LEARNING FOCUS ELA

LESSON DURATION 30 minutes

CLASS SIZE Up to 30

ACTIVITY TEAMS Pairs

MATERIALS

- 15 sets of Explanation/Description cards
- Journals or writing paper
- Pencils

ELA

- 4.RL.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- 4.L.4a Use context as a clue to the meaning of a word or phrase.
- 4.W.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

ACADEMIC VOCABULARY

trial
adaptation
explanation
description

ACTIVITY PROCEDURE

1. PREPARE THE ACTIVITY

Determine how students will be broken up into pairs for the activity. Instruct students to clear their desks of everything but pencils and journals or writing paper.

Ensure that the contents of the bags of explanation and description cards have been mixed up.

2. REVIEW TRAITS AND ADAPTATIONS

Remind students of the beaver adaptations they learned about in the science lesson. Have students list a few of them, and discuss what they help the beaver do or how it helps them survive.

Ask: What is a trait or characteristic?
A **trait** is a physical characteristic (e.g. body part) or behavior a plant or animal has. An example of a physical trait is the beaver's thick fur.

Ask: What is a adaptation?
An **adaptation** is a trait or characteristic a plant or animal has developed through evolution (passed down from generation to generation) that serves a specific function in their survival. Adaptations or changes may be physical (also called structural), behavioral, or physiological (occurring on the inside of the body). **Physical adaptations** present as a body part or function to help the organism survive. For example, the beaver's thick fur is a physical adaptation that helps to keep them warm in cool, wet environments. **Behavioral adaptations** present as activities or social structures to help the organism survive; for example, beavers are social and protect one another by slapping their tail on the water to warn others that predators are nearby.

3. DESCRIPTION VS. EXPLANATION

Inform students they will be put into pairs to play a sorting game. The goal of the activity is for students to read through given sentences about beavers and sort the sentences into two categories: sentences with a description of a beaver trait or characteristic, and sentences with an explanation of a beaver trait or characteristic.

Have students give an example of a **description**; for example, a student may say "the sweater you are wearing is red." Discuss with students how a description states the features of a trait, such as color, texture, size, etc.

However, an **explanation** will give more information about the topic than just what you notice. An example of an explanation may be, "the sweater you are wearing is red because it was made using red-dyed fabric." For the sorting game, an explanatory sentence will explain how a trait or characteristic is an adaptation for the beaver, and what function that trait serves.

4. PLAY THE SORTING GAME

Give each pair of students an envelope with a complete set of explanation and description cards inside.

Have student pairs go through their set of sentence cards and work together to place them into two columns on their desks. Remind students that each of the beaver's traits (underlined words on the cards) will have both an explanation and a description card, so each column will have the same amount of cards when they are done. Have students line them up so they are parallel in the lists.

After giving students ten to fifteen minutes to read and sort their cards, bring the class back together to go through their lists, calling on pairs to read one of their sets out loud. Follow up with questions about why they chose to sort them, such as "what word was a clue that the sentence was an explanation, and not just a description?" Refer to the answer key at the end of this lesson for the beaver traits and their sentences.

5. WRITE NEW SENTENCES

Have students reflect on the way the sentences are structured, coming to the conclusion that explanations are scientific in nature while descriptions are more basic and describe the subject with little connection to "why."

Ask: Which do you believe would be used in a scientific textbook about beavers? Which do you believe would be used in a poem or short story?
Discuss students' answers to ensure they are able to differentiate between descriptive and explanatory language.

Have students collect their pencil and paper or journal and find a comfortable place to write. Have students come up with their own explanation and description sentences about at least three traits of another animal that shares a habitat with beavers. Students may have to participate in some research using the Internet, a field guide, or an encyclopedia for information on the animal they choose. For example: A blue heron has a long, pointed beak (description); A blue heron uses its beak to stab fish out of the water (explanation).

Common animals that share habitat with beavers:

- Skunk
- Coyote
- Red-legged frog
- Bald eagle
- Great blue heron
- Dragonfly
- Salmon
- Deer

CLOSING CIRCLE

Invite students to share the sentences they came up with. To turn it into a guessing game, have students read their sentences, but omit the name of the animal they chose.

ASSESSMENT OPTIONS

Use students' written examples to assess if students understand traits and adaptations as well as descriptive vs. explanatory language.

Activity Answer Key:

Explanation	Description
The beaver's pelt keeps it warm in cold water.	The beaver's pelt is thick and brown.
The beaver's teeth help to get food from bark and cut tree parts for dams.	The beaver's teeth are long and chisel-shaped.
The beaver's oil keeps their fur waterproof and can help mark their territory.	The beaver's oil has a musky odor.
The beaver's tail helps it swim, warns off predators, and stores extra fat for when food is scarce.	The beaver's tail is very strong, flat, and looks like a paddle.
The nictitating membrane, or "clear eyelid," protects beavers' eyeballs when they swim underwater.	Beavers have a "clear eyelid" called a nictitating membrane that looks similar to a contact lens.
Beavers have nose and ear flaps that keep the water out when they are swimming.	Beavers have nose and ear flaps that can open and close.
On their back foot, a beaver's split nail acts as a comb to spread their oil all over their fur.	On their back foot, a beaver has a split nail that looks like a comb.
Beavers have webbed feet to help them swim.	Beavers have flat, rubbery webbed feet.
Beavers have sharp, durable nails that help them dig into the mud when building their lodges and dams.	Beavers have very sharp, durable nails and front paws that look like hands.

ELA LESSON

ACTIVITY CARDS

Print and cut out cards for one full set, and place in a bag.

The beaver's pelt keeps it warm in cold water.	Beavers have nose and ear flaps that keep the water out when they are swimming.
The beaver's teeth help to get food from bark and cut tree parts for dams.	On their back foot, a beaver's split nail acts as a comb to spread their oil all over their fur.
The beaver's oil keeps their fur waterproof and can help mark their territory.	Beavers have webbed feet to help them swim.
The beaver's tail helps it swim, warns off predators, and stores extra fat for when food is scarce.	Beavers have sharp, durable nails that help them dig into the mud when building their lodges and dams.
The nictitating membrane, or "clear eyelid," protects beavers' eyeballs when they swim underwater.	Beavers have nose and ear flaps that can open and close.
The beaver's pelt is thick and brown.	On their back foot, a beaver has a split nail that looks like a comb.
The beaver's teeth are long and chisel-shaped.	Beavers have flat, rubbery webbed feet.
The beaver's tail is very strong, flat, and looks like a paddle.	Beavers have very sharp, durable nails and front paws that look like hands.
Beavers have a "clear eyelid" called a nictitating membrane that looks similar to a contact lens.	The beaver's oil has a musky odor.

ART LESSON

ADAPTATION ADVERTISEMENT

SUMMARY

Have you ever wondered where we get inspiration for new technologies and products? Often, our human designs come from nature! This concept is called biomimicry. In this art activity, students will create an eye-catching advertisement for an imaginary product for humans that mimics a beaver adaptation.

OBJECTIVES

By the end of the lesson, students will be able to:

- Advertise an imaginary new product or technology based on beaver adaptations to show an understanding of how these traits help beavers survive in a competitive world
- Develop a creative poster and sales pitch to communicate an invention

GUIDING QUESTIONS

1. How does biomimicry inspire human products and technologies?

2. What are key features in a successful advertisement and sales pitch?

LESSON-AT-A-GLANCE

GRADE LEVEL 4

INTEGRATED LEARNING FOCUS ART

LESSON DURATION 30 minutes

CLASS SIZE Any

ACTIVITY TEAMS Groups of 3 - 4

MATERIALS:

- Poster paper (11x17") - one piece per group
- Pencils
- Coloring materials (crayons, markers, colored pencils)
- Beaver adaptation costume pieces

ART

- MA.2.CR2.4 Discuss, test, and assemble ideas, plans, and models for media arts productions, considering the artistic goals and the presentation.
- MA.10.CO1.4 Examine and use personal and external resources, such as interests, research, and cultural understanding, to create media artworks.

ACADEMIC VOCABULARY

biomimicry
physical adaptation
behavioral adaptation

ACTIVITY PROCEDURE

1. PREPARE THE ACTIVITY

Gather 11x17" paper, coloring supplies, and pencils and ensure students have clear desks and plenty of space to work.

Display the beaver adaptation costume pieces from the science lesson in the front of the room.

2. REVIEW BEAVER ADAPTATIONS

Ask: What traits do beavers have that help them survive in their habitat?
Go through each costume piece briefly, inviting students to share with the group what they recall about each trait:

- Teeth: cut-outs

Teeth are used to scrape nutritious bark from trees and shrubs, and cut tree parts to use for dams. Beavers teeth continue to grow throughout their lives, like our fingernails. Gnawing or chewing on wood helps to file their teeth down and keeps them sharp.

- Tail: cut-out attached to belt

The beaver tail helps beavers swim, it can be slapped on the water to warn their family of predators, and it also stores fat that can be used for energy when food is scarce.

- Nictitating membrane: goggles

Beavers spend a lot of time in the water, and their 'clear eyelid' protects their eyeballs from water and dirt and helps them to see while swimming.

- Nose/ear flap: clothespin and ear muffs

Similar to their extra eyelid, there is a flap on their nose and in each ear that closes when they go under water. (Beavers also have a lip behind their teeth so they can chew and carry things in their mouth underwater without getting water in their mouth.)

- Fur: furry/fuzzy coat

Beaver's fur coats are thick to keep them warm even in cold water. There is a layer of longer hair to keep water away from their body, and a layer of soft, downy hair that keeps them warm (also known as insulation).

- Oil: olive oil

(in a bottle; student may mime putting the oil on their fur and around their lodge)
Beavers make a special oil that they use to cover their fur in order to waterproof the fur and keep them extra warm. The oil has a strong musky odor and they sometimes put the oil on their homes and around their ponds to let other beavers know it's their territory.

- Split nail: comb

To help the beavers spread the oil over their fur, their feet have split nails. The nails split into two parts like a little comb which makes it easier for them to cover their fur in oil.

- Webbed feet: flippers

Remember, beavers spend most of their time in the water. In addition to their tail, their back feet are webbed to help them swim faster and stronger.

- Nails: gloves with nails

Beavers have tough nails on their front feet which help them dig in the mud. Their paws are a lot like hands and they use them to put mud into place on their dams and lodges.

3. DEFINE BIOMIMICRY

In this activity, tell students they will be using inspiration from nature to come up with an idea for a product, technology, or service inspired by one of the beaver adaptations they learned about.

The concept of taking inspiration from how nature solves problems is called **biomimicry**. Break down the word on the board, showing that *bio* - refers to the living world, and *mimicry* means "to imitate."

Examples of biomimicry to research on the Internet for inspiration:

- Trains designed after kingfisher birds' head shape and beaks to make them more aerodynamic
- Swimwear and coatings on boats designed after sharks' skin to move quickly through the water
- "Self-cleaning" paint designed after the bumpy texture of lotus petals, which allow for dirt and oils to roll off the surface with water

- Adhesive (sticky) materials designed after gecko feet, which use increased surface area to climb vertically

More resources on examples of biomimicry:

- Ask Nature - a search engine for finding the creative ways that nature solves problems www.asknature.org
- The Biomimicry Institute - empowering people to create nature-inspired solutions for a healthy planet; they have even developed a curriculum called Sharing Biomimicry with Young People for K-12 teachers who want to dig in further! www.biomimicry.org https://asknature.org/resource/sharing-biomimicry-with-young-people/

  One excellent example of the beaver costume items are the gardening gloves with plastic nails attached. Have students think about why the inventor of these gloves added this feature, and discuss the possibility that they were possibly inspired by an animal that digs through soil such as a beaver or a mole.

4. BRAINSTORM A PRODUCT OR TECHNOLOGY

Break students up into small groups of three or four, and direct them to take five to ten minutes to brainstorm ideas for their product, technology, or service.

Before moving on to the next step, check in with each group and make sure they have an idea that they all agree on. You may need to assist groups in brainstorming, using inspiration from online resources, or leading a discussion about the beaver adaptations you learned about.

Remind students that there are **physical** (or structural) adaptations, such as a beaver's fur or teeth. There are also **behavioral** adaptations, such as the way beavers are social animals that live together in a lodge instead of building their own individual lodges.

5. CREATE AN ADVERTISEMENT

Once student groups have their idea and are ready to create an advertisement they may begin sketching their ideas on a piece of scrap paper. Once they have completed a rough draft, they may collect an 11x17" piece of paper and their desired coloring materials.

Give students enough time to finish their poster and prepare a short "sales pitch" to make in front of the class when everyone has finished. They may use props from the unit if needed.

6. MAKE A SALES PITCH

To close the activity, have student groups present their posters to the class.

Remind students they should communicate:

- What their product, technology, or service is,
- What inspired its design, and
- How it mimics an adaptation or trait of the American beaver.

CLOSING CIRCLE

Have students write an individual reflection on paper or in a writing journal answering the prompt, "Imagine all of the inventions your classmates came up with were made into real products or services. Of the class's inventions, which one(s) would you buy for your own use and why?"

ASSESSMENT OPTIONS

Determine whether groups' posters and sales pitches communicated the right amount of information and correctly utilized the concept of biomimicry.

APPENDIX
IMAGE ATTRIBUTIONS

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