



## Lesson 1: Mountain Organisms Patterns & Traits

**Core Alignment: 5<sup>th</sup> Grade – Standard 5 – Objective 1**

a. Make a chart and collect data identifying various traits among a given population.

### Intended Learning Outcomes:

- Observe simple objects, patterns, and events and report their observations.
- Compare things, processes, and events.
- Describe or explain observations carefully and report with pictures, sentences, and models.
- Use classification systems
- Cite examples of how science affects life.
- Science is a way of knowing that is used by many people not just scientists.

### Vocabulary:

organism, trait, pattern

Optional: taxonomy, taxonomic division (domain – species)

**Time Commitment:** These lessons are designed to provide a great deal of flexibility in both length and depth. Plain text in black contains the middle-of-the-road option, while text in red contains time-saving options and text in purple contains options to dive deeper into the subject matter.

30–50 minutes, 15–30 minutes, and 60+ minutes.

## Lesson Summary

Students search for patterns within a selection of organisms found within the Northern Utah Mountain Ecosystems. Through grouping the organisms and subsequent discussion, they discover the concept of traits. The scientific field of taxonomy, which builds on an understanding of those trait, can be explored as well as the difference between living (biotic) and non-living (abiotic).

## Essential Questions

- How do patterns of characteristics in an organism unite or separate them from other organisms?
- What are the sources of an organism's characteristics?
- How can knowledge of an organism's characteristics be utilized?



## Enduring Understanding

- All organisms possess a library of traits.
- Identifying traits is an exercise in recognizing patterns, and the more you familiarize yourself with an organism the easier it is to distinguish those patterns.
- **Knowledge of an organism's traits, and those traits sources, can be utilized for humans benefit.**

## Previous Knowledge

Your students might not know it yet, but they are trait finding machines! Discovering traits is largely an exercise in finding patterns and the human brain is a pattern-seeking device that more efficiently stores information in patterns.

## Background Information

The Patterns & Partnerships Botany Bin explores the ecosystem of the Northern Utah Mountains, namely the Wasatch Range and Uinta Mountains, but is largely applicable to the Rocky Mountain ecosystem as a whole. As encouraged by the NGSS and SEEd standards, we are focusing on one ecosystem as opposed to taking a small sampling of ecosystems across the world. We begin this exploration by looking for patterns in the biotic components of the ecosystem to understand how they are similar and dissimilar from each other (traits), and potentially to understand one way that knowledge is utilized by taxonomists. This exploration helps to familiarize students with the organisms they will study throughout this Bin, introduces them to the idea and term of traits, and sets the stage for the next lesson which explores the origin and effects of those traits in differing ecosystems.

In exploring traits, we focus on the Crosscutting Concept of Patterns. At its core identifying traits is an exercise in finding patterns, and human brains are pattern finding machines. The more familiar we are with an organism, the easier it is to notice the differences between similar organisms and the similarities between different organisms. Mountain organisms will be familiar to many of your students and are a fun and engaging way to explore patterns and traits.

It can be disconcerting for students, and teachers, to engage in more phenomena-based learning, where there is not necessarily one right answer. The journey is as important as the destination, and we hope that your students' journey through this lesson helps them to stretch their minds and practice their scientific thinking skills. Your students will likely come up with some creative and interesting answers, but we have yet to see a pattern that was observed that could not be tied back to a trait. You may need to stretch your creative and scientific muscles as well!



# Lesson Plan:

## Mountain Organisms – Patterns & Traits

Materials	Location
Fauna Photos	Fauna Photo Folder
Plant & Organism Rikers	Botany Bin
Blackline: L1 Mountain Organisms – Patterns & (Traits)	Addendum Folder – Tab L1 OR USB – L1 folder
Pencils or Pens	Classroom supplies
White/Smart Board for group discussion	Classroom supplies
Optional for Taxonomy Extension:	
Blackline: L1 Taxonomic Levels	Addendum Folder – Tab L1 OR USB – L1 folder
Blackline: L1 Mountain Organisms – Taxonomy & Traits	Addendum Folder – Tab L1 OR USB – L1 folder

### Preparation

- There are 108 different specimens in the bin, so there are likely more specimens than students in your class. This is wonderful in that it allows your students to encounter a larger variety of organisms during their time with the bin, but also necessitates a little forethought when choosing specimens for the activities. **We recommend taking 5–10 minutes to familiarize yourself with the organisms in the bin before you conduct any of the lessons.**
- For the following two activities you will want to select a sampling of organisms that showcase a variety of traits. To make the exercise easier, you can only choose organisms that have noticeably different traits. **For more of a challenge, choose organisms that are more similar.**
- **For a quicker lesson (as described further below) you will want to preselect a few examples showing a variety of traits.**



## Set-up

- To make this activity more phenomenon-based it is written to **have the vocabulary of “trait” revealed after the activity.**
- **To save time this section can be done with fewer organisms, by using the Fauna photos only.** We recommend using the plant and insect specimens along with the fauna photos for a more trait-filled experience, as well as a fuller introduction to the biotic components of the ecosystem they will study. **If you would like to add a sneak peek to differentiating abiotic and biotic components of an ecosystem, add the lichen/rock samples as well.**
- Explain that the students will look at photos of organisms found in Utah’s Mountain Ecosystems for patterns, and then use the patterns they find to create groups of similar organisms.
  - Define patterns. (Patterns are a consistent or recurring feature that can be physical or an event.) Emphasize that students are looking for patterns (of features) that allow them to create groups in a given collection. They should create the groups based on the patterns that make the most sense to them.
  - Define organism. (Organisms are living things that can act as an individual or carry out its life activities on its own.)
  - Discuss how seeing and understanding patterns is a valuable scientific skill. It can lead to a deeper understanding of the organism being investigated and how it fits within and interacts with its ecosystem.
  - Introduce the idea that there are scientists that specialize in using patterns to understand and categorize organisms (taxonomists).
- It can be helpful to explain to students that there is no one right answer. Help them to understand that the process of looking for patterns and creating groups is meant to exercise their ability to think logically and scientifically. Encourage them to relax and be creative.
- Break the students into teams (3 to 5 total teams works best).
  - **This activity can be done as a class to save time, preselect a few images to display and discuss as a class.**
  - **To practice the scientific skills of Engaging in Argument from Evidence and Communicating Information.** We suggest breaking the teams into role, including Facilitator, Spokesperson, Timekeeper, and Devil’s Advocate as outlined in the USB addendum folder document “Suggested Group Discussion Roles.”



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- Divide the organisms among the teams.
  - **Teacher Tip:** This activity works best if the students have a variety of organisms so you'll want to pay attention to creating diversity as you distribute them.
  - **Allow the students time to look at the photos as individually and search for patterns. This can help them to form their own conclusions. We suggest approximately 2 minutes.**

## Activity

- Give the teams a set amount of time to complete the activity. **3-5 minutes for Fauna Photos only, 5-8 minutes if using all the specimens.**
- Ask the students to create a number of groups from their organisms based on the patterns they observe. **If using only the Fauna Photos, 3 to 5 groups works well. If using all of the specimens, asking for 5-8 groups works well.**
  - The goal is to have the students group the organisms based on their traits, regardless of what traits they choose, so there are no "wrong" answers.
- Have them use the first 2 sheets of the worksheet "Mountain Organisms - Patterns & \_\_\_\_" to record the groups and their reasoning for the groups/patterns observed.
  - This is a great time to introduce your students to the immortal words of MythBuster's Adam Savage, "Remember kids, the only difference between [playing] around and science is writing it down."
  - **Naming the groups allows for a connection to the following extension on taxonomy but can be a fun exercise regardless.**

## Discussion

- As a class, have each team share the patterns they observed and the groups they created from those patterns. List the patterns (traits) on your white or smart board.
  - Have the students record the results of the discussion on the third page of the Mountain Organisms - Patterns & \_\_\_\_\_ worksheet.
  - **This step can be streamlined by displaying the specimens to the class, and by identifying patterns. Immediately ask the class to voice their agreement or disagreement and reasons why.**
  - **You can use this time as an exercise in Engaging in Argument from Evidence when students have conflicting ideas on how groups should be sorted! If one of the team**



roles is Devil's Advocate, this would be a time for them to help assemble and voice their team's objections.

- Introduce the vocabulary term of **traits**. (Traits are a physical or behavioral characteristic of an organism).
  - Have the students add the term traits to the title of their worksheets and at the end of the third page of their worksheet.
- Based on the class's discussion, have the students decide on 4 traits that they found the most useful for sorting the organisms. Ask them to re-sort their organisms based on those traits. Have them record the traits chosen and count of each organism with those traits on the 4<sup>th</sup> page of the Mountain Organisms – Patterns & \_\_\_\_\_ worksheet.
  - There are two different versions of the chart used in this section. Depending on the number of organisms you have distributed to your class you can either preselect the chart that is applicable or give your students the challenge of choosing the correct chart for their data.

## Taxonomy and Traits

Your students can now look at the traits they found in the organisms they studied in terms of how those traits help scientists to understand the relationships between organisms.

- Explain how all organisms have traits that define them as part of a larger group or as individuals. It can be helpful to point out the traits listed on the board and discuss which traits differentiate and/or unite some of the canines that were grouped.
- Introduce the vocabulary term of taxonomist. (A taxonomist is a scientist who studies traits and the ways organisms can be grouped).
- Discuss how taxonomists have long used the traits organisms possess to organize them into different levels of groups and understand how they might be related.
  - The 8 main taxonomic groups help to sort and differentiate the similarity of traits between organisms.
  - The Taxonomic Levels handout highlights the patterns of traits that can be found between some of the animals found in the organisms shown in this bin.
- Ask the students about the name they gave their groups. Explain how taxonomists give groups of organism's names as well. These names can be used to communicate effectively and efficiently throughout the globe due to use of Latin-based scientific names. They also allow scientists and laypeople to learn more about that organism, as taxonomist Dr. Stephen



## RED BUTTE GARDEN BOTANY BINS



Clark says, “Knowing an [organism’s] name allows you to unlock all knowledge on that [organism].”

- You can also discuss the difference between common names, which can vary not only by geographic location but also by person, and scientific names, which are the same regardless of location, person, or the person’s language.
- Distribute the informational Taxonomic Levels and Traits handout and have the students complete the Mountain Organisms: Taxonomy & Traits worksheet using the organisms they investigated in the previous section.
- If you would like more background information on taxonomy please visit the USB for some wonderful resources!

## Assessment

Students should demonstrate an understanding of the concept of a trait, that traits vary within a species, and between species. **An understanding of taxonomy as a categorization of traits could also be included.** Informal observations can be made as students are working; observe how they are filling in the charts, if they are engaged, etc. Make anecdotal notes of students’ verbal responses during discussions. The worksheets can also be used as either a note of participation, understanding, or critical thinking.

## Extensions

- This activity can be repeated for practice by switching the organisms between teams, asking for new and different groups, or by asking for subgroups. More worksheet copies will be needed.
- An excellent lesson plan on phylogenetic classification (based on evolutionary relationships) can be accessed at: <https://link.springer.com/article/10.1007%2Fs12052-009-0122-7> or as a pdf on the L1 USB in the extension folder.

Name(s): \_\_\_\_\_ Date: \_\_\_\_\_

Look through the organisms for patterns. Use the patterns you observe to sort the organisms into groups. Using one box per group, list the organisms you chose for each group and the pattern(s) you grouped those organisms together.

<b>Organisms in this group:</b> _____ _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	



# Mountain Organisms – Patterns & \_\_\_\_\_

Name(s): \_\_\_\_\_ Date: \_\_\_\_\_

Look through the organisms for patterns. Use the patterns you observe to sort the organisms into groups. Using one box per group, list the organisms you chose for each group and the pattern(s) you grouped those organisms together.

<b>Organisms in this group:</b> _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	

# Mountain Organisms – Patterns & \_\_\_\_\_

Name(s): \_\_\_\_\_ Date: \_\_\_\_\_

**What patterns did other teams use to group the organisms?**

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**Which groups/ observed patterns made the most sense to you? Why?**

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**Which groups/ observed patterns made the least sense to you? Why?**

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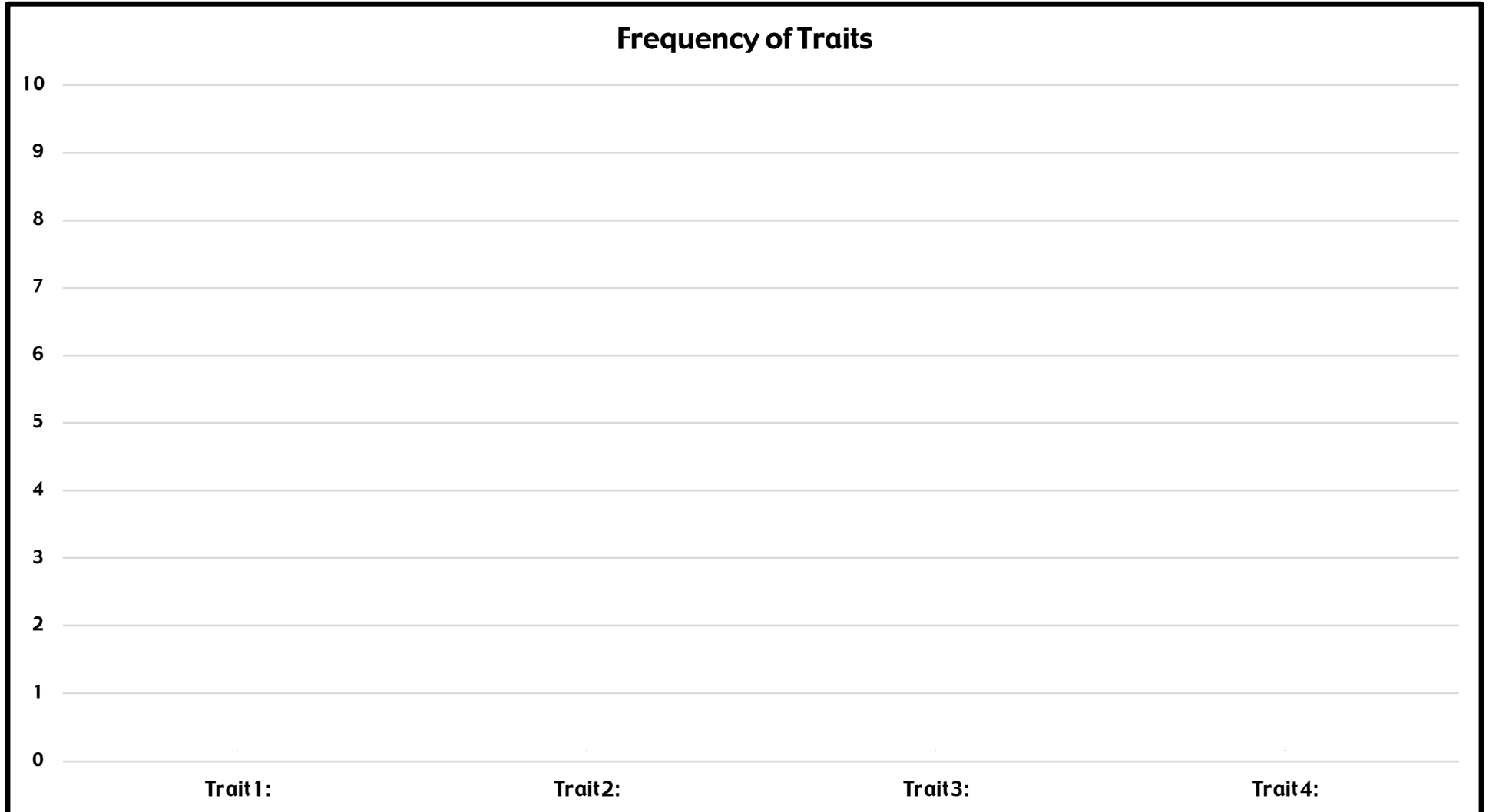
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**What is the scientific term for the characteristics of an organism that determines how the organism looks, acts or functions? \_\_\_\_\_**

# Mountain Organisms – Patterns & \_\_\_\_\_ Chart

Name(s): \_\_\_\_\_ Date: \_\_\_\_\_

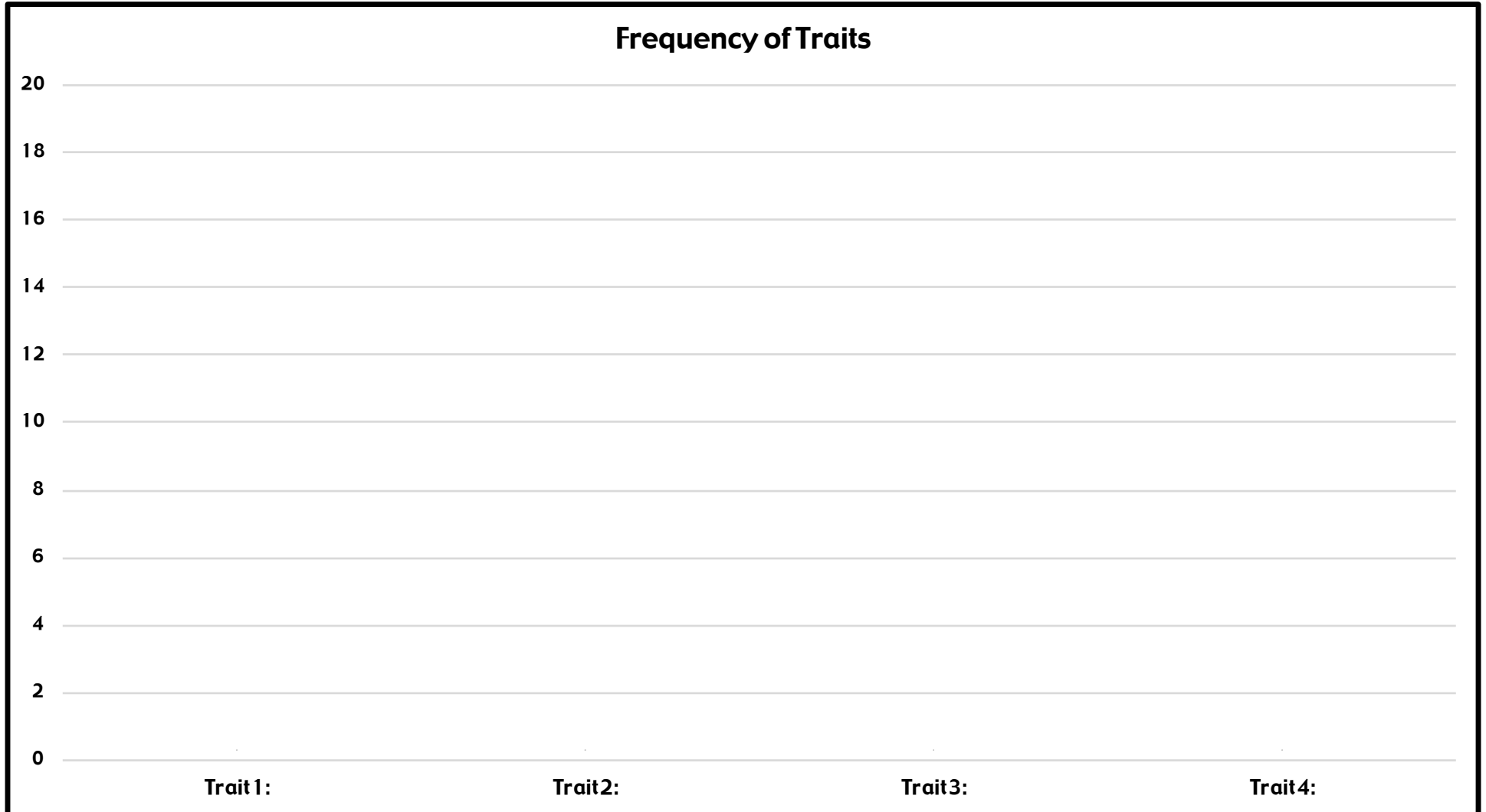
Choose the four traits that you think made the most sense to use to sort the organisms into groups and list them along the bottom of the chart. Sort your organisms by those four traits and create a count of how many organisms had each trait. Graph your conclusions on the chart below.



# Mountain Organisms – Patterns & \_\_\_\_\_ Chart

Name(s): \_\_\_\_\_ Date: \_\_\_\_\_

Choose the four traits that you think made the most sense to use to sort the organisms into groups and list them along the bottom of the chart. Sort your organisms by those four traits and create a count of how many organisms had each trait. Graph your conclusions on the chart below.



# Mountain Organisms – Patterns & Traits

Name(s): TEACHER GUIDE Date: \_\_\_\_\_

Look through the organisms for patterns. Use the patterns you observe to sort the organisms into groups. Using one box per group, list the organisms you chose for each group and the pattern(s) you grouped those organisms together.

<p><b>Organisms in this group:</b></p> <p><u>Coyote</u></p> <p><u>Bobcat</u></p> <p><u>Ermine</u></p> <p>_____</p> <p>_____</p>	<p><b>What patterns did you observe in this group?</b></p> <p><u>Fur</u></p> <p><u>Predator</u></p> <p><u>4 Legs</u></p> <p>_____</p> <p>_____</p>
<p><b>Name this group based on its patterns:</b> <u>Hunters</u></p>	
<p><b>Organisms in this group:</b></p> <p><u>Deer</u></p> <p><u>Moose</u></p> <p><u>Bighorn Sheep</u></p> <p>_____</p> <p>_____</p>	<p><b>What patterns did you observe in this group?</b></p> <p><u>Hooves</u></p> <p><u>Prey</u></p> <p><u>Fur</u></p> <p>_____</p> <p>_____</p>
<p><b>Name this group based on its patterns:</b> <u>Hooves</u></p>	
<p><b>Organisms in this group:</b></p> <p><u>Great Gray Owl</u></p> <p><u>Osprey</u></p> <p><u>Rufous Hummingbird</u></p> <p><u>Sandhill Crane</u></p> <p><u>Big Brown Bat</u></p> <p>_____</p> <p>_____</p>	<p><b>What patterns did you observe in this group?</b></p> <p><u>Wings</u></p> <p><u>Flying</u></p> <p>_____</p> <p>_____</p>
<p><b>Name this group based on its patterns:</b> <u>Flyers</u></p>	
<p><b>Organisms in this group:</b></p> <p><u>King Bolete</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p><b>What patterns did you observe in this group?</b></p> <p><u>Mushroom</u></p> <p><u>Grows in Ground</u></p> <p>_____</p> <p>_____</p>
<p><b>Name this group based on its patterns:</b> <u>Mushrooms</u></p>	

# Mountain Organisms – Patterns & Traits

Name(s): TEACHER GUIDE Date: \_\_\_\_\_

Look through the organisms for patterns. Use the patterns you observe to sort the organisms into groups. Using one box per group, list the organisms you chose for each group and the pattern(s) you grouped those organisms together.

<b>Organisms in this group:</b> <u>Paintbrush</u> <u>Sticky Geranium</u> <u>Choke Cherry</u> _____ _____	<b>What patterns did you observe in this group?</b> <u>Leaves</u> <u>Green Color</u> <u>Flowers</u> _____ _____
<b>Name this group based on its patterns:</b> <u>Flowers</u>	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	
<b>Organisms in this group:</b> _____ _____ _____ _____ _____	<b>What patterns did you observe in this group?</b> _____ _____ _____ _____ _____
<b>Name this group based on its patterns:</b> _____	

Name(s): TEACHER GUIDE Date: \_\_\_\_\_

What patterns did other teams use to group the organisms?

Scales

Tails

Wings

Bark

Beaks

Which groups/ observed patterns made the most sense to you? Why?

Varied answers, highly dependent on the students experience but you're looking for signs of critical thinking.

Which groups/ observed patterns made the least sense to you? Why?

Varied answers, highly dependent on the students experience but you're looking for signs of critical thinking.

What is the scientific term for the characteristics of an organism that determines how the organism looks, acts or functions? **Traits**

# Mountain Organisms – Taxonomy & Traits

Name: \_\_\_\_\_ Date: \_\_\_\_\_

What type of scientist studies the grouping of organisms and their traits as groups and individuals? \_\_\_\_\_

First record the 8 taxonomic divisions in the first column. Choose three of the organisms you studied, each from a different group that you created. Look at each organism’s label and record the name and 8 taxonomic categories for each organism below.

Taxonomic Division	Organism 1 Name:	Organism 2 Name:	Organism 3 Name:

Circle the two organisms that have the most taxonomic categories in common. Do you notice more traits in common between those organisms than the third, more distantly related, organism? \_\_\_\_\_

At which taxonomic division do the two organisms break off or diverge? \_\_\_\_\_



# Mountain Organisms – Taxonomy & Traits

Name: TEACHER GUIDE Date: \_\_\_\_\_

What type of scientist studies the grouping of organisms and their traits as groups and individuals? Taxonomist

First record the 8 taxonomic divisions in the first column. Choose three of the organisms you studied, each from a different group that you created. Look at each organism's label and record the name and 8 taxonomic categories for each organism below.

Taxonomic Division	Organism 1 Common Name: <b>Big Brown Bat</b>	Organism 2 Common Name: <b>Mule Deer</b>	Organism 3 Common Name: <b>Osprey</b>
Domain	Eukarya	Eukarya	Eukarya
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata
Class	Mammalia	Mammalia	Aves
Order	Chiroptera	Artiodactyla	Accipitriformes
Family	Vespertilionidae	Cervidae	Pandionidae
Genus	Eptesicus	Odocoileus	Pandion
Species	fuscus	hemionus	haliaetus
Scientific Name: <small>Genus and species</small>	<i>Eptesicus fuscus</i>	<i>Odocoileus hemionus</i>	<i>Pandion haliaetus</i>

Circle the two organisms that have the most taxonomic categories in common. Do you notice more traits in common between those organisms than the third, more distantly related, organism? Depends on student, look for reasoning

At which taxonomic division do the two organisms break off or diverge? Order / After Class

# Taxonomic Levels and Traits

Traits  
less similar

Canadian Lynx    Bobcat    Mountain Lion    Wolf    Moose    King Snake    Swallowtail    Spruce

**Domain**



**Domain Eukarya:** Has cells with membrane bound organelles. Includes Plantae, Protista, Animalia, and Fungi

**Kingdom**



**Kingdom Animalia:** Eukaryotes that are multicellular, heterotrophic, and usually mobile

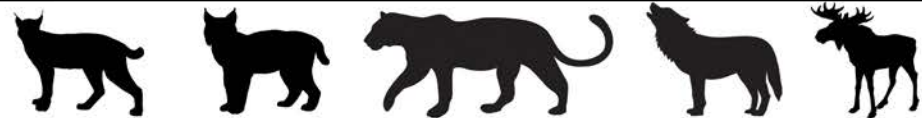
**Phylum**

(Division for Plants/Fungi)



**Phylum: Chordata:** Animalia with notochords, dorsal hollow nerve chords, etc...

**Class**



**Class Mammalia:** Chordata that are warm-blooded, produce milk, and have hair

**Order**



**Order Carnivora:** Mammalia that have teeth specialized for cutting meat

**Family**



**Family Felidae:** Carnivora with retractable claws and flexible bodies

**Genus**



**Genus Lynx:** Felidae with bobbed tails and ear tufts

**Species**



**Species *Lynx canadensis*:** Lynx with larger ear tufts

Traits  
more similar