

## CURRICULUM SUPPLEMENT

# GUESS WHO?

## A PLANKTON IDENTIFICATION ACTIVITY

For use with the **Investigation** section of **GULF WATCH ALASKA: THE MYSTERY OF THE BLOB**

**Overview:** Gulf Watch scientist Sonia Batten has to identify many different species of plankton when she reviews the results from the continuous plankton recorder. It is important to be able to correctly identify different species of phytoplankton and zooplankton to determine which species are capable of producing toxins under stress and how the species composition throughout the Gulf of Alaska is changing over time. There are multiple ways to classify plankton to species level. Some can be identified by observing their physical characteristics with the microscope and comparing them with similar organisms. Some, but not all, organisms that are very similar in many respects, are closely related. Next, the students will be introduced to using dichotomous keys to identify different plankton species found in the Gulf of Alaska, utilizing the sorting skills they learned in the first activity. To drive home this concept application, students will then exhibit their understanding by taking objects found around the classroom to build their own dichotomous key to key out the objects with emphasis on observable, distinguishing characteristics. Students will also consider the structure of plankton appendages in terms of their functions. This activity will be introduced with a comparison of the structure and function of the parts of everyone's shoes in the classroom.

### Learning Objectives:

The student will:

- *Relate the information learned from the **Investigation** section to **explore the use of classification tools used in the laboratory and out in the field.***
- *Understand and be able to infer relationships by **investigating the correlation between structure and function** when identifying unknown organisms.*
- *Utilize the knowledge learned to **create their own dichotomous key** to exhibit their understanding of organism classification and identification.*

### Standards Addressed:

#### **Alaska Science GLEs:**

<https://education.alaska.gov/akstandards/standards/standards.pdf>

5<sup>th</sup>: SA1.1, SA1.2, SC2.1

6<sup>th</sup>: SA1.1, SC2.1

7<sup>th</sup>: SA1.1, SC2.1

8<sup>th</sup>: SA1.1

#### **Ocean Literacy Principles:**

<http://oceanliteracy.wp2.coexploration.org/ocean-literacy-framework/principles-and-concepts/>

OLP #5 The ocean supports a great diversity of life and ecosystems.



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### Materials/Location Needed:

- Plankton Species Cards (4 for each student)
- Plankton Dichotomous Key (1 for each student)
- Student Worksheet (1 for each student)
- 2 Large bins to store student shoes

**Teaching Time:** 60 minutes

**Preparation Time:** 15 minutes

### Background:

Suppose you found a shell lying on the beach and you wanted to know what kind of animal it came from, what's the first thing you'd do? Probably, you'd want to carefully examine it, observing its unique physical characteristics. Physical traits are an important tool that anyone can use when identifying an unknown species.

A **dichotomous key** is designed to help in identifying something by answering a series of questions about it. If you were using a dichotomous key to identify your shell, you would go through a series of 'yes' or 'no' questions about the characteristics of the shell. Depending on the answer to each question, you'd be guided to another question. When all of the questions had been answered you'd arrive at the identity of the unknown shell. A little like the game 20 Questions.

In this activity, students will use a simple dichotomous key to identify a series of phytoplankton and zooplankton found commonly in the Gulf of Alaska (2 versions of this key are available, one visual, one written). In the process of identifying the phytoplankton, the students will be able to determine which species in the Gulf of Alaska are capable of producing toxins that can become concentrated as they move up the food web.

### Directions:

1. **Activity 1:** After completing the **Investigation** section of *Gulf Watch Alaska: The Mystery of the Blob*, introduce the concept of structure and function with a class challenge. Have each student take off one shoe and put it in a plastic bin or tub.
  - a. We suggest having students knock off loose debris from the shoe outside before donating it to the pile.
  - b. Once the shoes are collected, feel free to make a grand gesture of dumping the pile onto a large, front table, proceeding to spray the pile with some air freshener for effect.



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2. Ask your students how you could come up with a way to sort all of the shoes to return them to the proper owners. What are some ways you could separate and group the shoes?
  - a. Allow students an opportunity to share their suggestions for how to organize and separate the shoes. As vocabulary terms such as 'classification', 'categorization', etc., arise, write them down on the board and discuss their meaning.
3. Organize students into small groups and provide each student with a piece of scratch paper. Ask the class if they were to put the shoes into two or three different groups, what would they be? Then how would you further divide those groups up?
  - a. Allow for small-group discussion time, then whole-group discussion time to explore ideas before choosing a common category for each level of classification needed for the shoes.
  - b. Keep in mind to discuss ideas such as 'dark vs. light' or 'small vs. large' and how exact language and concrete use of properties of the shoes, or readily observable traits, are much better for classification purposes to allow other people outside of your classroom to understand what you are talking about.
    - i. You can demonstrate this concept to students by showing and discussing how saying a shoe is 'small' or 'dirty' can be unclear when comparing to different things or using someone else's eyes.
  - c. Keep the discussion and sorting going until all of the shoes have been sorted, and thus a simple classification chart constructed on the board.
4. Before using your classification chart to re-distribute shoes to their owners, discuss with the class how sorting, categorizing, and classifying can be done in a variety of ways in the scientific community, including Carl Linnaeus's system for naming organisms, Dmitri Mendeleev's organization of chemical elements, or even categorizations in mathematical contexts.
  - a. This is where you can begin to draw the discussion to highlight the relationship of structure and function. You can do this by asking students to take the time to compare the structural features of different shoe types and how they related to the overall functions of different types of shoes, such as how a gym shoe's structure and function compares to those of a rain boot or a sandal.
5. To return the shoes to the proper owners, take each shoe out of the bin and work through the classification chart. This can be a great time to bring someone from outside the classroom to put your chart to the test, including a para, janitor, fellow teacher, or even the principal.
  - a. To add a level of further discussion, feel free to sneak a few extra shoes into the bin, and use the chart as best as possible to classify the shoe, discussing the pros and cons of your chart along the way, as well as how utilizing criteria of structure (boots, sandals) or function (e.g., running shoes, climbing shoes) can help one classify the unknown.



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### Activity 2:

1. Once everyone has their proper shoes back on, bring the discussion back to the **Investigation** page of *Gulf Watch Alaska: The Mystery of the Blob*. This can be done by having the students offer a brief recap of what you have learned so far about the mystery happening in the Gulf.
  - a. Discuss with students how part of researcher Sonia Batten's role in the case was to investigate the species of plankton present in the Gulf during those troubling years. Sonia mentioned that the composition of phyto- and zooplankton species were different in those years than in normal years. How was she able to discover this? *By using standard classification techniques to identify the species collected and observed.*
2. To properly classify organisms into related groups, there are many routes a researcher can take, including studying DNA or comparing and contrasting physical characteristics and internal anatomical structures.
  - a. With many species of plankton, however, scientists can build a tool that relies on physical characteristics that can be observed under the microscope to sort and classify them to their species or species group in the same way students were able to sort their shoes by structure. This tool is called a *dichotomous key*, and works just like the classification chart produced with the shoes.
3. Students will now get the chance to use a dichotomous key to identify common species of phytoplankton and zooplankton found in the Gulf of Alaska, and determine which are capable of producing the toxins being investigated by the Gulf Watch Alaska team.
  - a. Pass out four plankton cards to each student. Encourage them to begin closely inspecting their species, making note of what unique or familiar characteristics they have that might make them easy to group together, as well as stand apart.
  - b. After students have had time to look at their plankton cards, pass out the dichotomous keys.
    - i. There are two different types of dichotomous keys provided. One in the traditional dialogue format, the other depicting the same information but with pictures of the organisms to match with. It is up to the teacher how you would like to present these to the students. Some students may benefit from one more than the other, or all students may benefit from starting with the picture representation before moving on to the traditional style.
  - c. Remind students that a dichotomous key works in the same way as the game they've just played. Each answer leads to another question which leads closer to the identity of their species. To extend this activity, have students switch plankton cards when done with their first set.

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**Activity 3:**

1. Create an extension of the first two activities by having students create their own dichotomous key relating the structure of 7-8 objects found around the classroom, such as different desk / office supplies, backpacks, or objects that don't readily have a connection!
  - a. Once students have completed their dichotomous key, have them test it by swapping objects and keys with a neighbor.

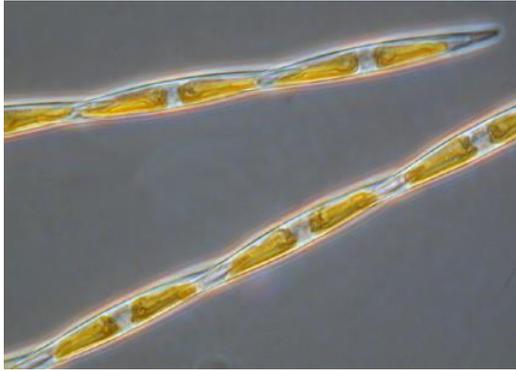
**Assessment:**

Students can be assessed on participation in many aspects of the activity and/or their success at completion of the worksheet.

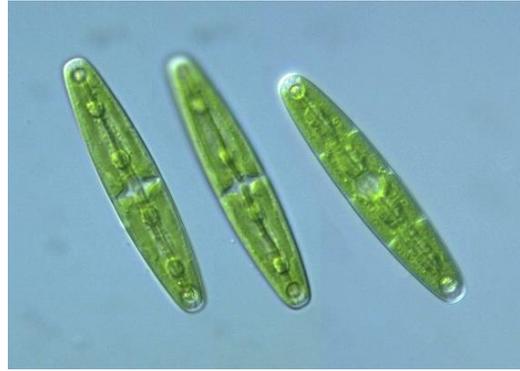


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Plankton Identification Cards



*Pseudo-nitzschia* spp.



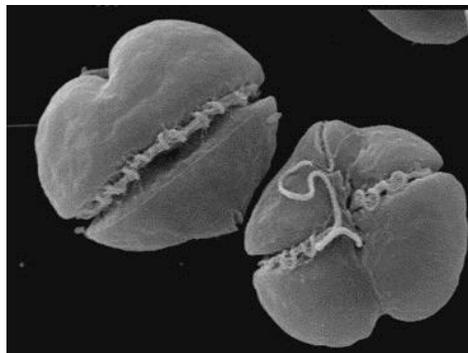
*Navicula* morphotype



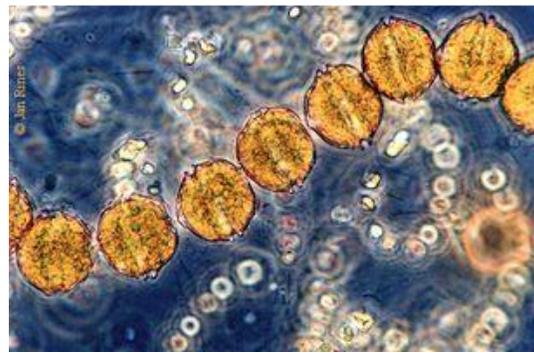
*Melosira* spp.



*Coscinodiscus* morphotype



*Gymnodinium breve*



*Alexandrium catenella*

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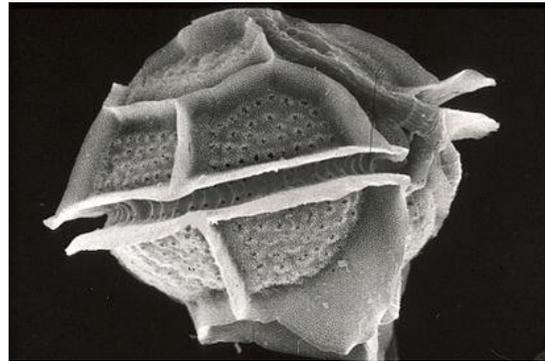
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Plankton Identification Cards



*Alexandrium monilatum*



*Pyrodinium bahamense*



*Pyrodinium bahamense var. compressum*



*Mnemiopsis leidyi*



*Mertensia ovum*



*Elminius modestus*

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## CURRICULUM SUPPLEMENT

## Plankton Identification Cards



*Pelagobia longicirrata*



*Calanus* spp.

Further information and images can be found at the following resources:

<http://accs.uaa.alaska.edu/files/kachemak-bay/marinephytoplanktonkachemakbay.pdf>

[http://accs.uaa.alaska.edu/files/kachemakbay/marinephytoplanktonkachemakbay\\_studentguide.pdf](http://accs.uaa.alaska.edu/files/kachemakbay/marinephytoplanktonkachemakbay_studentguide.pdf)

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## Plankton Dichotomous Key

1. a. With appendages (arms / tentacles / legs).....Go to 6  
b. Without appendages (arms / tentacles / legs).....Go to 2
2. a. With whip-like structure (flagella).....Go to 4  
b. Without whip-like structure (flagella).....Go to 3
3. a. Long, thin body shape.....Pennate  
b. Rounded body shape.....Concentric
4. a. Body covered in armored plates.....Go to 5  
b. Body without armored plates.....*Gymnodinium*
5. a. Body with multiple segments.....*Alexandrium*  
b. Body without segments.....*Pyrodinium*
6. a. Body gelatinous with rows of hair-like cilia.....Ctneophora  
b. Body not gelatinous, lacking rows of hair-like cilia.....Go to 7
7. a. With a hard shell.....Crustacean  
b. Without a hard shell.....Polychaete

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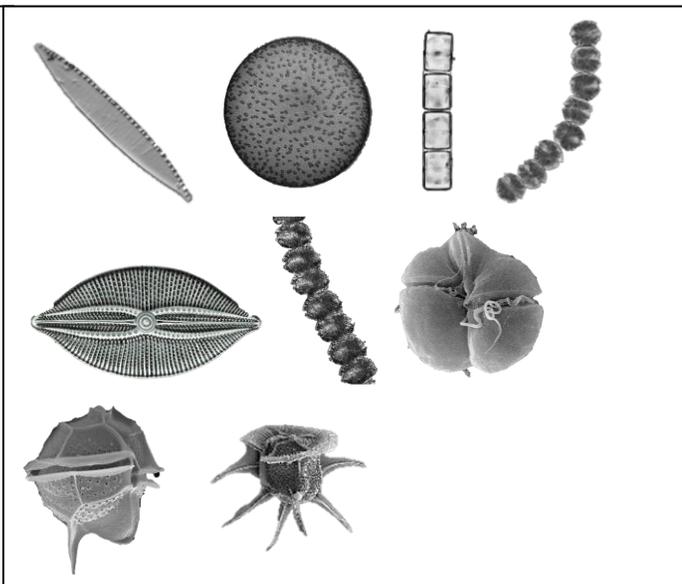


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Plankton Dichotomous Key Visual

1. a. With appendages (arms / tentacles / legs)

b. Without appendages (arms / tentacles / legs)

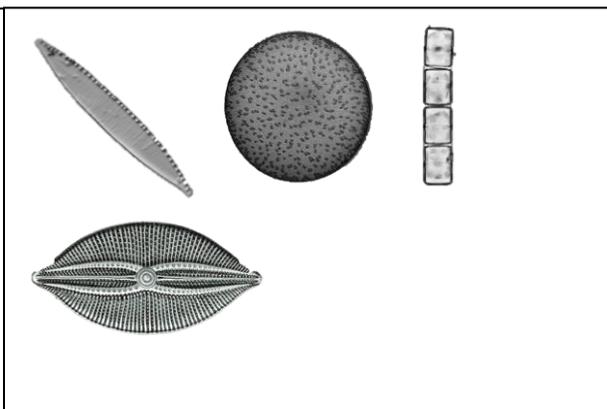
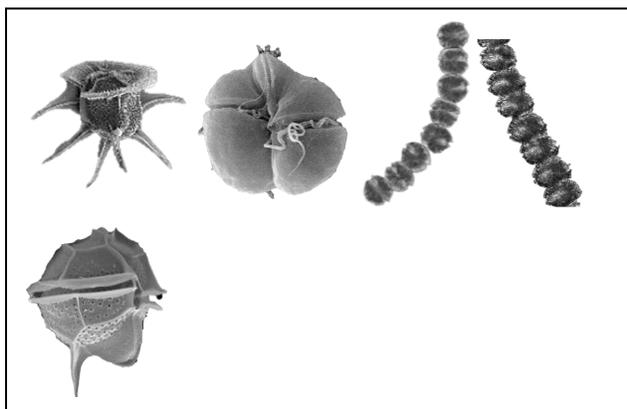


...go to 6

...go to 2

2. a. With whip-like structure (flagella)

b. Without whip-like structure (flagella)



... go to 4

... go to 3

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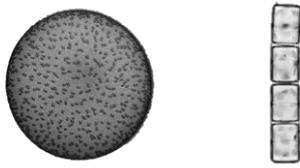
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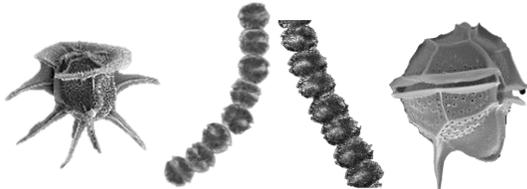
3. a. Long, thin body shape

b. Rounded body shape

<p>YOUR PLANKTON IS.... <b>A PENNATE DIATOM</b></p>  <p><i>Pseudo – nitzschia spp.</i>                      <i>Navicula spp.</i></p> <p style="text-align: center;">↓</p> <p><b>YOUR PLANKTON IS TOXIC!</b></p>	<p>YOUR PLANKTON IS....<b>A CONCENTRIC DIATOM</b></p>  <p><i>Coscinodiscus morphotype</i>              <i>Melosira spp.</i></p>
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4. a. Body covered in armored plates

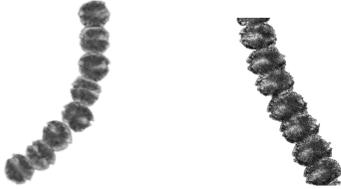
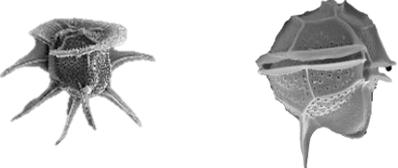
b. Body without armored plates

	 <p>YOUR PLANKTON IS.... <b><i>Gymnodinium breve</i></b></p> <p><b>YOUR PLANKTON IS TOXIC!</b></p>
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... go to 5

5. a. Body with multiple segments

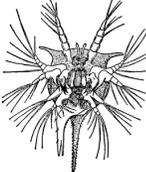
b. Body without segments

<p>YOUR PLANKTON IS... <b><i>Alexandrium spp.</i></b></p>  <p><i>Alexandrium catenella</i>    <i>Alexandrium monilatum</i></p> <p><b>YOUR PLANKTON IS TOXIC!</b></p>	<p>YOUR PLANKTON IS... <b><i>Pyrodinium spp.</i></b></p>  <p><i>Pyrodinium bahamense</i>    <i>Pyrodinium bahamense</i> var. <i>compressum</i></p> <p><b>YOUR PLANKTON IS TOXIC!</b></p>
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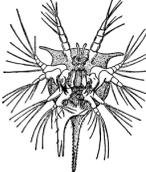
6. a. Body gelatinous with rows of hair-like cilia    b. Body not gelatinous, lacking rows of hair-like cilia

<p>YOUR PLANKTON IS... <b>A CTENOPHORA</b></p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <p><i>Mnemiopsis leidyi</i></p> <p><i>Mertensia ovum</i></p> </div>	<div style="display: flex; justify-content: space-around; align-items: center;">    </div>
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... go to 7

7. a. With a hard shell

- b. Without a hard shell

<p>YOUR PLANKTON IS... <b>A CRUSTACEAN</b></p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <p><i>Elminius modestus</i></p> <p><i>Calanus spp.</i></p> </div>	<p>YOUR PLANKTON IS... <b>A POLYCHAETE</b></p> <div style="display: flex; justify-content: center; align-items: center; margin-top: 20px;">  </div> <p style="text-align: center; margin-top: 10px;"><i>Pelagobia longicirrata</i></p>
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3. Below are pairs of shoes. Underneath each pair, list structures of each shoe, such as the type or shape of sole, laces or closed-toe, fabric or materials, etc. Next to each structure, briefly consider what its function for the shoe may be, and write that with the structure.

**Example:**

Laces: Keep the shoe tight on your foot

Strap band: Keep your foot from leaving the shoe





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**Activity 2:**

1. What observations can you make about the plankton species on your cards? Use the lines below to list some similarities and differences you spot on your plankton.

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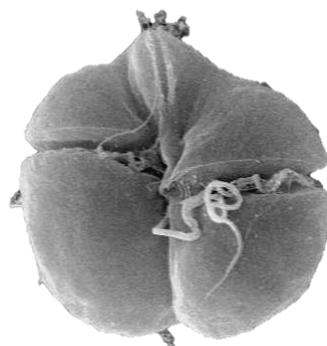
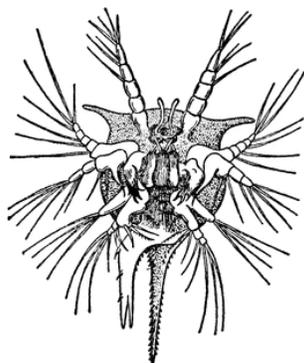


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2. What did you determine are the identities of your first 4 plankton species?

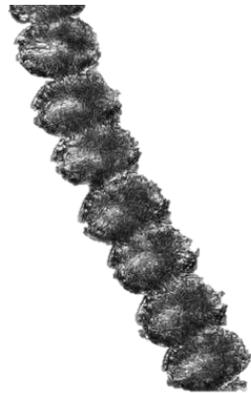
1. \_\_\_\_\_ **TOXIC or NON-TOXIC?**
2. \_\_\_\_\_ **TOXIC or NON-TOXIC?**
3. \_\_\_\_\_ **TOXIC or NON-TOXIC?**
4. \_\_\_\_\_ **TOXIC or NON-TOXIC?**

3. As with the shoe activity on the last page, below are pairs of plankton species that you were able to identify. With each pair, list structures you observe on the organisms, and take a guess as to what those structure may be used for. Think biologically, such as, could these structures be used for locomotion, feeding, protection, etc.



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4. When using the dichotomous key to identify your species of plankton, did you notice a trend between the groupings of organisms? Still following the theme of readily observable structures, what are some other ways that you can think of grouping these organisms?

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**Activity 3:**

1. List below the 7-8 objects you will use to create your dichotomous key.
  
  
  
  
  
  
  
  
  
  
2. Compare and contrast your objects. What makes them similar? Different? How do their varying structures and functions compare?



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3. Brainstorm ways to categorize your objects. Start by thinking of two big categories that can separate all of your objects, then break those two categories up into two more, and continue doing so until each object has its own category. Use the space below to map out your category breakdown and begin building your dichotomous key.

4. Use the following page to write out your dichotomous key.



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

**Create Your Own Dichotomous Key**

List your objects: \_\_\_\_\_

1. a. \_\_\_\_\_

b. \_\_\_\_\_

2. a. \_\_\_\_\_

b. \_\_\_\_\_

3. a. \_\_\_\_\_

b. \_\_\_\_\_

4. a. \_\_\_\_\_

b. \_\_\_\_\_

5. a. \_\_\_\_\_

b. \_\_\_\_\_

6. a. \_\_\_\_\_

b. \_\_\_\_\_

7. a. \_\_\_\_\_

b. \_\_\_\_\_

8. a. \_\_\_\_\_

b. \_\_\_\_\_

