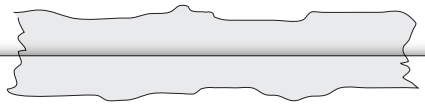
The NASA SCI Files™

The Case of the Zany Animal Antics

Segment 1



Animals become the topic of the day when Catherine and Bianca encounter an injured animal while on an airboat ride in Orlando, Florida. Determined to learn more about animals and how to help and protect them, the tree house detectives decide to visit Mr. Rob Yordi, Zoological Manager at Busch Gardens Williamsburg. Mr. Yordi introduces Kali to the grey wolf while he explains how and why animals are classified. Next, Kali meets Dr. D at the Virginia Marine Science Museum in Virginia Beach, Virginia where he explains eight of the various phyla of invertebrates. Meanwhile, Catherine and Bianca head to NASA Kennedy Space Center (KSC) to meet Ms. Rebecca Smith, a wildlife ecologist. Ms. Smith describes five classes of vertebrates and explains why it is important for NASA to monitor the animals at KSC, and she even introduces the girls to one of her reptile friends!

Objectives

Students will

- learn how animals are classified.
- differentiate between invertebrates and vertebrates.
- identify various characteristics of invertebrates.
- understand how to use a dichotomous key.
- recognize differences between warm (endothermic) and cold (ectothermic) blooded animals.
- identify various characteristics of the five classes of vertebrate animals.

Vocabulary

amphibian—an ectothermic (cold-blooded) vertebrate that spends some time on land but must breed and develop into an adult in water. Frogs, salamanders, and toads are examples of amphibians.

Annelida—(segmented worms)—any of various worms having segmented bodies separated by internal partitions

Arthropoda—(arthropod)—any of a phylum of animals without backbones (such as insects, arachnids, and crustaceans) having a segmented body, jointed limbs, and a chitin shell that is shed periodically

bioluminescence—emission of visible light by living organisms such as the firefly and various fish, fungi, and bacteria

bird—a member of the class Aves, including endothermic (warm-blooded), egg-laying, feathered vertebrates with forelimbs modified to form wings

Chordata (chordates)—an animal that has a dorsal hollow nerve cord, notochord, pharyngeal pouches, and a muscular tail during at least part of development

class—a group of similar orders whose members have at least one characteristic in common

classify—to arrange in or assign to classes

cnidaria (cnidarians)—aquatic animals such as jellyfish and coral that are mostly carnivorous, with two layers of true tissues, radial symmetry, and tentacles bearing stinging cells

dichotomous key—a series of pairs of phrases or descriptions that are used to classify a group of living things by making choices between the sets of traits and characters described in each pair

Echinodermata (echinoderms)—any of a phylum of marine animals (such as starfish and sea urchins) that have a number of similar body parts (as the arms of a starfish) arranged around a central axis, often a calcium-containing outer skeleton, and a water-vascular system

ectotherm—an animal that maintains its body temperature by absorbing heat from its environment. All animals other than birds and mammals are ectotherms.

endoskeleton—the internal skeleton of an animal, especially of a vertebrate

endotherm—an animal that is able to maintain a constant body temperature despite changes in the temperature of its environment

fish—an ectothermic (cold-blooded) vertebrate that lives and breathes in water and has a typically long, scaly tapering body, limbs that develop as fins, and a vertical tail fin

invertebrate—an animal that does not have a backbone or vertebral column

Kingdom—one of the main taxonomic groups consisting of closely related phyla

mammal—any of a class of endothermic (warm-blooded) vertebrates that include human beings and all other animals that nourish their young with milk produced by mammary glands and have skin usually more or less covered with hair

metamorphosis—a complete or marked change in the form of an animal as it develops into an adult, for example, the change from tadpole to frog or from caterpillar to butterfly

Mollusca (mollusks)—any of a large phylum of invertebrate animals (such as snails, clams, and octopuses) with soft bodies lacking segments and usually enclosed in a shell containing calcium

***Nematoda* (nematode or roundworm)**—any of various worms having unsegmented threadlike bodies, many of which, such as the hookworm, are parasitic

phylum—group of closely related classes sharing one or more major characteristics that set them apart from other animals or plants

Platyhelminthes (flatworms)—any of various free-living or parasitic worms having three layers of tissues and bilateral symmetry

Porifera (sponges)—aquatic filter feeders with an internal skeleton made up of spongin and/or spicules of calcium carbonate or silica but that lack true tissues and organs

reptiles—any of a group of ectothermic (cold-blooded) air-breathing vertebrates (such as snakes, lizards, turtles, and alligators) that usually lay eggs and have skin covered with scales or bony plates

vertebrates—animals that have a vertebral column or backbone

Video Component

Implementation Strategy

The NASA SCI Files™ is designed to enhance and enrich existing curriculum. Two to three days of class time are suggested for each segment to fully use video, resources, activities, and web site.

Before Viewing

1. Before viewing Segment 1 of *The Case of the Zany Animal Antics*, read the program overview to the students. List and discuss questions and preconceptions that students may have about how oceans are formed, the tides and currents in oceans, and what causes ocean waves.
2. Record a list of issues and questions that the students want answered in the program. Determine why it is important to define the problem before beginning. From this list, guide students to create a class or team list of three issues and four questions that will help them better understand the problem. To locate the following tools on the NASA SCI Files™ web site, select **Educators** from the menu bar, click on **Tools**, and then select **Instructional Tools**. You will find them listed under the **Problem-Based Learning** tab.

Careers

animal curator
aviculturist
biologist
wildlife ecologist
zoological manager

Problem Board—Printable form to create student or class K-W-L chart

Guiding Questions for Problem Solving—Questions for students to use while conducting research

Problem Log and Rubric—Students' printable log with the stages of the problem-solving process

Brainstorming Map—Graphic representation of key concepts and their relationships

The Scientific Method and Flowchart—Chart that describes the scientific method process

3. **Focus Questions**—These questions at the beginning of each segment help students focus on a reason for viewing. They can be printed ahead of time from the **Educators** area of the web site in the **Activities/ Worksheet** section under **Worksheets** for the current episode. Students should copy these questions into their science journals prior to viewing the program. Encourage students to take notes while viewing the program to help them answer the questions. An icon will appear when the answer is near.
4. **"What's Up?" Questions**—These questions at the end of the segment help students predict what actions the tree house detectives should take next in the investigation process and how the information learned will affect the case. You can print them by selecting **Educators** on the web site in the **Activities/Worksheet** section under **Worksheets** for the current episode.

View Segment 1 of the Video

For optimal educational benefit, view *The Case of the Zany Animals* in 15-minute segments and not in its entirety. If you are watching a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. Have students reflect on the "What's Up?" Questions asked at the end of the segment.
2. Discuss the Focus Questions.
3. Students should work in groups or as a class to discuss and list what they know about the oceans of the world. Have the students conduct research on the difference between currents, tides, and waves. Brainstorm ideas about how the tennis shoes may have ended up on the beach. As a class, reach a consensus on what additional information is needed. Have the students conduct independent research or provide them with the information needed.
4. Have the students complete **Action Plans**, which can be printed from the **Educators** area or the tree house **Problem Board** area in the **Problem-Solving Tools** section of the web site for the current online investigation. Students should then conduct independent or group research by using books and Internet sites noted in the **Research Rack** section of the **Problem Board** in the **Tree House**. Educators can also search for resources by topic, episode, and media type under the **Educators** main menu option **Resources**.
5. Choose activities from the **Educator Guide** and web site to reinforce concepts discussed in the segment. The variety of activities is designed to enrich and enhance your curriculum. Activities may also be used to help students "solve" the problem along with the tree house detectives.
6. For related activities from previous programs, download the **Educator Guide**. On the NASA SCI Files™ home page, select **Educators**. Click on **Episodes** in the menu bar at the top. Scroll down to the 2003–2004 Season and click on *The Case of the Prize-Winning Plant* In the green box, click on **Download the Educator Guide**.

a. In the **Educator Guide** you will find

a. **Segment 1** – *Classic Classifying*

7. Have the students work individually, in pairs, or in small groups on the problem-based learning (PBL) activity on the NASA SCI Files™ web site. To locate the PBL activity, click on **Tree House** and then the **Problem Board**. Choose the 2004–2005 Season and click on *Mystery Animals of KSC*.
   - To begin the PBL activity, read the scenario *(Here's the Situation)* to the students.
   - Read and discuss the various roles involved in the investigation.
   - Print the criteria for the investigation and distribute.
   - Have students begin their investigation by using the **Research Rack** and the **Problem-Solving Tools** located on the bottom menu bar for the PBL activity. The **Research Rack** is also located in the **Tree House**.
8. Having students reflect in their journals what they have learned from this segment and from their own experimentation and research is one way to assess student progress. In the beginning, students may have difficulty reflecting. To help them, ask specific questions that are related to the concepts.
9. Have students complete a **Reflection Journal**, which can be found in the **Problem-Solving Tools** section of the online PBL investigation or in the **Instructional Tools** section under **Educators**.
10. The NASA SCI Files™ web site provides educators with general and specific evaluation tools for cooperative learning, scientific investigation, and the problem-solving process.

Resources *(additional resources located on web site)*

Books

Doris, Ellen: *Real Kid, Real Science Books: Entomology, Marine Biology, and Invertebrate Zoology*. Thames and Hudson, 1994, ISBN: 0500190054.

Farndon, John: *1000 Facts on Animals.* Backpack Books, 2003, ISBN: 0760737495.

Feeley, Kathleen: *Invertebrates.* Gareth Stevens Publishing, 2002, ISBN: 0836832167.

Kalman, Bobbie and Nickles, Greg: *What is the Animal Kingdom?* Crabtree Publishing, 1997, ISBN: 086505889X.

Pringle, Laurence: *Scholastic Encyclopedia of Animals.* Scholastic, Inc., 2001, ISBN: 0590522531.

Schaefer, Lola and Saunders-Smith, Gail: *What Is an Amphibian? Vol. 1.* Capstone Press, 2001, ISBN: 0736808639. *(Note: This is the first volume in a series of What Is books, including What Is a Bird, Reptile, Mammal, and Insect.)*

Smithyman, Kathryn: *What Is an Arthropod?* Crabtree Publishing, 2002, ISBN: 0865059683.

Taylor, Barbara: *Animal Kingdom.* Silver Dolphin Books, 2000, ISBN: 1571454446.

Whyman, Kathryn: *Animal Kingdom: A Guide to Vertebrate Classification and Biodiversity.* Raintree Publishers, ISBN: 081725885X.

Video

Disney Channel: *Invertebrates (Bill Nye the Science Guy)*
Grades 3–8

Disney Channel: *Mammals (Bill Nye the Science Guy)*
Grades 3–8

Schlessinger Media: *Animal Life in Action: Animal Classification*
Grades 5–8

Web Sites

NASA Kennedy Space Center: Alligators and Rocket Ships
Come learn how NASA Kennedy Space Center, located on Merritt Island off the east coast of Florida, shares its home with manatees, alligators, sea turtles, and an array of animals. Find out how NASA is working to protect this national wildlife refuge.
http://www.nasa.gov/centers/kennedy/shuttleoperations/alligators/kscovrv.html

ProTeacher! Animal Lesson Plans
This site has lesson plans for grades K–5, including endangered species activities, programs and thematic units, web quests, coloring pages, and much more.
http://www.proteacher.com/110006.shtml

DiscoverySchool.com – The Secret of the Bones
A paleontologist has discovered some animal bones. Help figure out what species the animal is through this interactive game.
http://school.discovery.com/sciencefaircentral/dysc/virtuallabs/bones/index.html

Cool Cosmos – Infrared Zoo Gallery
Ever wonder what the difference is between warm and cold-blooded animals? Visit the Infrared Zoo Gallery and use infrared light to see how different animals look.
http://coolcosmos.ipac.caltech.edu/image_galleries/ir_zoo/

Classifying Critters
The Howard Hughes Medical Institute web site helps children learn animal classification through its interactive site.
http://www.hhmi.org/coolscience/critters/index.html

Kidport Think-and-Learn: The Animal Kingdom
Visit this web site to learn about animal classification. There are specific links to vertebrates and invertebrates.
http://www.kidport.com/RefLib/Science/Animals/Animals.htm

Animal Diversity Web
On this University of Michigan Museum of Zoology web site you can learn more about specific classes of animals. Find detailed information about a class, including pictures, sound clips, specimens, and classifications.
http://animaldiversity.ummz.umich.edu/site/index.html

Animal Classifications – Vertebrates
This web site offers a wealth of information about vertebrates, including specific links to other vertebrate web sites for particular animals.
http://falcon.jmu.edu/~ramseyil/vertebrates.htm

Invertebrates
Third and fourth graders in the United Kingdom did a superb job creating this site. Learn interesting facts, see some cool pictures, and learn more about invertebrates. You might also be inspired to create your own classroom web site!
http://atschool.eduweb.co.uk/sirrobhitch.suffolk/invert/inverteb.htm

Activities and Worksheets

Alike or Different?

Segment 1

Purpose

To understand how to use various characteristics to classify objects

Materials

2–4 groups of 4–5 students each

Background

We classify things everyday to organize and better understand them. To classify an object, we look at the characteristics or features that differentiate it from other objects and divide objects into groups based on these characteristics. For example, if given a box of toys, you might sort them by toys for boys and toys for girls and then further sort them by type of toy.

Procedure

1. In your group, list possible characteristics you can use to sort each student into one of two groups. For example, if everyone in your group has either blonde or brown hair, you might want to use hair color as the characteristic for sorting. Decide on 1–3 characteristics and be sure not to let the other groups know the characteristic(s) you are using!
2. Once you have decided on the characteristic(s), determine who is in which group.
3. When it is your group's turn, stand in front of the class in your sorted groups and have the other students try to figure out which sorting characteristic(s) you used. Of course, the more characteristics you use, the harder it will be for them! For example, depending on your group, you could use gender, hair color, and the absence or presence of shoelaces in group members' shoes.
4. Be creative choosing the sorting characteristics and try to use your imagination when guessing the other groups' characteristics too!

Conclusion

1. Was it difficult to find common characteristics in your group? Why or why not?
2. How did you determine which characteristics other groups used? Were they obvious or difficult to determine?
3. What do you think is the greatest challenge in classifying animals?

Extension

Collect an assortment of animal pictures and determine which characteristics you can use to classify them. How are they alike? How are they different? Sort the pictures into two groups, making sure that in each group there is something the same about all the animals in that group and that no animal in the other group has that particular characteristic. Have other students look at your groupings and try to guess why you grouped the animals the way you did.

The Involution of an Invertebrate

Segment 1

Purpose

To create an imaginary invertebrate based on characteristics of real invertebrates

Teacher Note: Prior to this activity, have the students conduct the activity, The Many Phyla of Invertebrates, or a similar activity to learn about the characteristics of the various invertebrate phyla. This activity and others can be found on the NASA SCI Files™ web site *http://scifiles.larc.nasa.gov* in the **Educators** area. In the tool bar at the top of the **Educators** area, click on **Activities and Worksheets** and then click on the **2004–2005 Season**. Scroll down to *The Case of the Zany Animal Antics* and click.

Materials

paper
colored pencils
booklets from The Many Phyla of Invertebrates (optional)
reference books for invertebrates

Background

Many of the most frightening "monsters" dreamed up for science-fiction movies, books, and even games are often actually based on bits and pieces of anatomy (body parts) and behavior of real invertebrates.

Sample Sketch

Procedure

1. Choose a habitat. It might be a dessert, a rain forest, a coral reef, or even the inside of another animal.
2. Describe the characteristics of the habitat. For example, does the habitat get a lot of rain or is it dry most of the year? Is it hot or cold? Note: If you're not sure of the characteristics of your habitat, conduct research.
3. Using the habitat's characteristics, define the environmental challenges that an invertebrate will have to overcome in the habitat.
4. After defining all the challenges, look over the characteristics of all the invertebrate phyla you have studied and pick the body systems (endoskeleton, wings, tentacles, and so on) that are best for your chosen habitat. They don't all have to be in the same phylum. Be creative!
5. Assemble (draw) the body systems you have chosen into an imaginary animal. Make sure that everything works well together. For example, you cannot expect an animal to breathe through its skin if it has an impermeable exoskeleton covering its entire body.
6. Label the diagram with the names of the real-life invertebrate systems. If necessary, draw a cutaway diagram showing the inside of your animal.
7. Color and name your new imaginary invertebrate.
8. On the back of your drawing, write a short description of your invertebrate, describe its features, and tell how it overcame the challenges of the habitat.
9. Share your imaginary invertebrate with your group and/or class.

Extension

1. Write a science fiction story about your new invertebrate.
2. Brainstorm for a list of science fiction "monsters" that have been created from invertebrates. Describe their body parts and systems and tell which real-life invertebrate each came from.

Animal Antics*

Segment 1

Purpose

To understand how scientists classify animals

Teacher Note: This activity deals with classification on an elementary level and is not intended to be complete but rather to expose students to the idea of classifying animals into groups according to attributes they have in common.

Materials

Per Student
animal book pages (p. 24)
Data Chart (p. 27)
Graphing Sheet (p. 28)
#19 rubber bands

Per Group
animal bags
Classification Chart (p. 25-26)
scissors
tape
Animal Picture Sheet (p. 29)

Teacher Prep

1. Assemble one bag of animals for each group of students. The bag should contain several of the pictures from the Animal Picture Sheet (page 29).
2. Bags may be supplemented with some or all of the following: animal cookies, crackers that look like fish, candy shaped like worms, or plastic bugs, spiders, snakes, and lizards. No two bags should be the same.
3. Each group will need one copy of the two-page classification chart cut along the dashed line and taped together to form one large page.

Background

The animal kingdom can be classified into two groups—the vertebrates and the invertebrates. Vertebrates are animals with backbones and can be classified into five subgroups: mammals, birds, fish (four classes), reptiles, and amphibians. The invertebrates are classified into many groups but for this activity will only be sorted into four subgroups: ringed worms, arthropods (insects, spiders, crabs), mollusks (slugs, squid, snails), and echinoderms (spiny-skinned animals like sea stars, sea urchins, and sand dollars).

Procedure

1. Begin assembly of the animal book pages by folding each page in half. See diagram 1.
2. Fold each page in half again. See diagram 2.
3. Look at the bottom of each page for the page numbers in the lower corners and nest the two folded pages together so that page one is on top and page 3 nests inside. See diagram 3.
4. Open the booklet to pages 4 and 5 and slip the rubber band over the book until it is in the center of the fold. See diagram 4.
5. In your team or as a class, read the information and discuss.
6. Open your bag and look through the animals in your bag for 5–10 minutes. Note any characteristics of the animals that might help you identify them.
7. Return the animals to the bag.
8. The object of this game is to correctly identify as many animals as possible. Use the animal booklet to help you determine how to classify each animal in the bag.

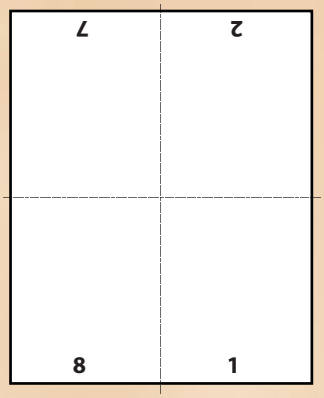


Diagram 1

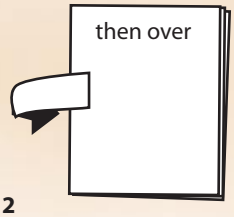
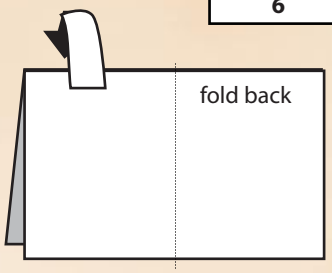


Diagram 2



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Animal Antics*

Segment 1

9. Assemble the Classification Chart by cutting along the dashed line and taping it into place after aligning the pages correctly.
10. Look at the Classification Chart and note the number of points given for each class.
11. Predict how many points your group will get and record your prediction on the Data Chart.
12. Empty the bag of animals and place them in the center of the Classification Chart in the space labeled "All Animals."
13. Count the number of animals and record this value on the data chart.
14. Begin classification of the animals by dividing them into vertebrates and invertebrates.
15. Once the teacher has checked your groupings, give your team one point for each correct placement.
16. Record the point values on the data chart for the number of correct vertebrates and invertebrates.
17. Continue sorting animals into the categories listed on the Classification Chart.
18. When your team is finished, have the teacher check for correct placement.
19. Determine the total number of correctly placed animals for each group. Multiply the total by the number of points that group is worth. For example, if you correctly classified three reptiles, multiple 3 (total number correctly classified) by 4 (point value for reptiles) for a total of 12 points.
20. Record your points for each group of animals on the data sheet.
21. Determine the Team Total and record.
22. Share your score with the other teams in the class, and as they share their scores, record them in the spaces provided on the Graphing Sheet.
23. Graph each team's score and declare a winning team.

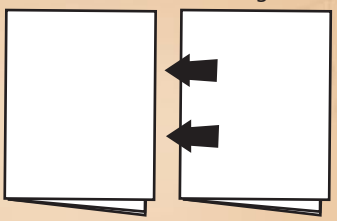


Diagram 3

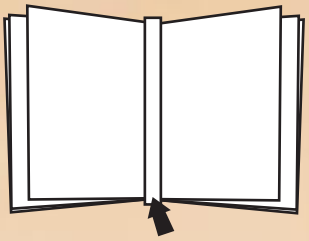


Diagram 4

Conclusion

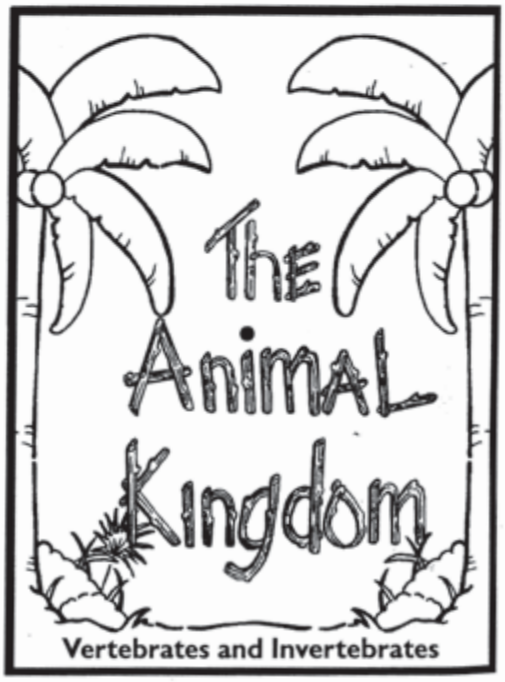
1. Was your team's predicted score close to your actual score? Why or why not?
2. How do common characteristics help you classify animals?
3. How would you sort the mammals into smaller categories?
4. Can you devise an animal classification system that is different from the one given on the chart? Explain.
5. What animals would you like to add to the chart? Where would they fit?
6. Think of another animal to add to each group.

Extension

1. Find the ratios or percents of animals in each category.
2. Color the cut-out animals and make a zoo collage.
3. Read Rudyard Kipling's Just So Stories and write your own animal story to explain how an animal got its unique features.
4. Create a classroom classification chart on butcher paper and paste animal pictures on the chart in the appropriate places.
5. Research the other four classes of fish and the other classes of invertebrates that were not included in the chart.

Animal Antics*

Segment 1



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8

Animals can be classified into two groups. The *vertebrates* are animals with backbones. The *invertebrates* are animals without backbones.

Run your hand down your back. Do you feel the bumpy bones? That is your backbone.

You are a vertebrate. Only about 5% of all the animals on Earth are vertebrates.

2

There are many groups of invertebrates. Here are four of the main ones:

- **Annelids:** cold-blooded animals that have soft bodies with sections
- **Echinoderms:** cold-blooded animals that have bodies with rough skin and sharp spines
- **Mollusks:** cold-blooded animals with a soft body and sometimes a hard shell
- **Arthropods:** cold-blooded animals with jointed legs

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Animal Antics*

Segment 1

Invertebrates are far more numerous than vertebrates. Of all the animals that have been discovered on Earth, about 95% are invertebrates. The largest group of invertebrates is the arthropods, which includes insects. Insects make up about 75% of all known animal species.

There are five groups of vertebrates:

- **Mammals:** warm-blooded animals that have hair or fur and are born alive
- **Birds:** warm-blooded animals that have feathers and lay eggs
- **Fish:** cold-blooded animals that have scales, gills, and fins and lay eggs
- **Reptiles:** cold-blooded animals that have scales and lungs and lay eggs
- **Amphibians:** cold-blooded animals that have smooth skin and can live on land or in water

Warm-blooded animals have constant body temperatures. Cold-blooded animals have body temperatures that adjust to the temperatures of their environments.

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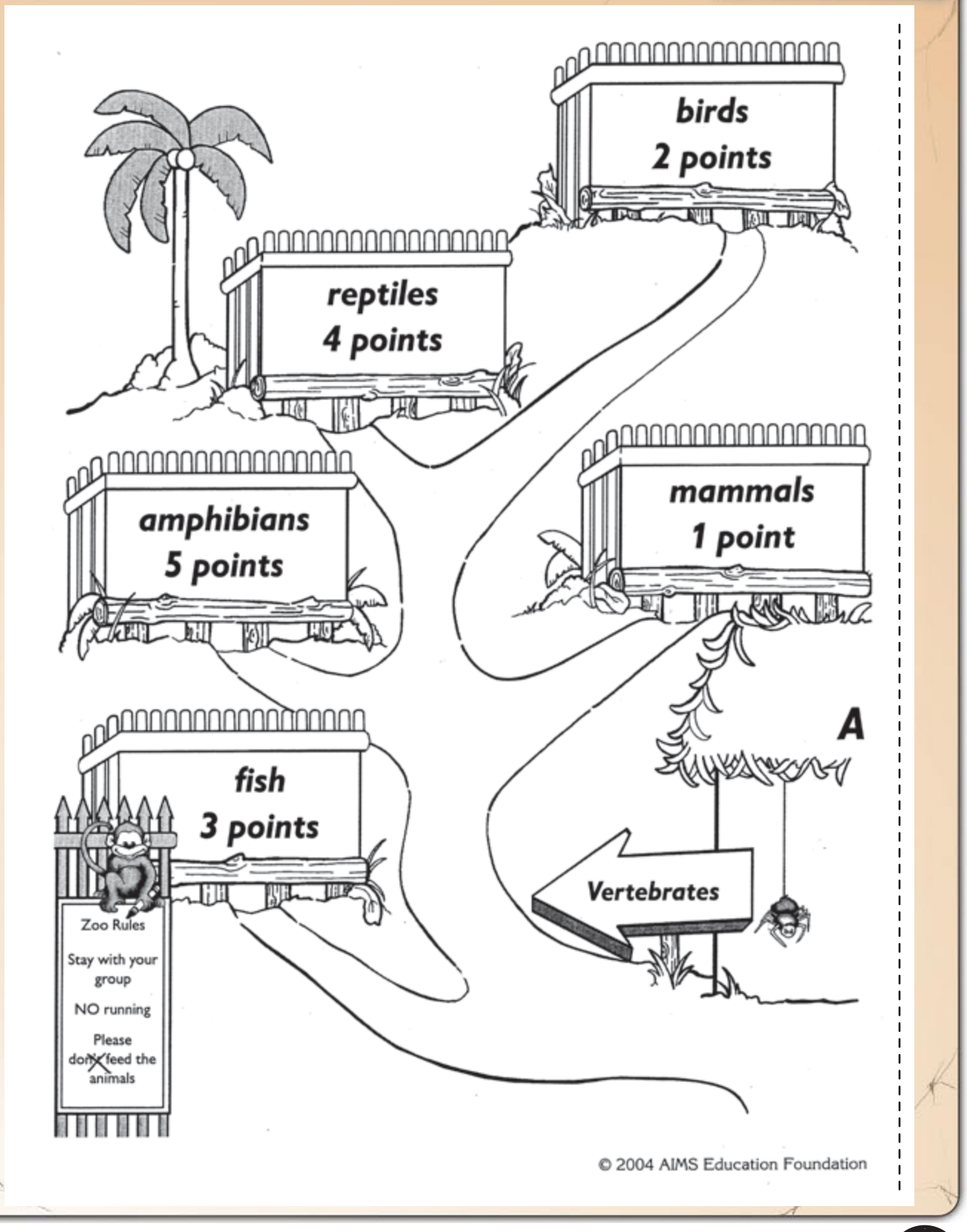
Animal Antics*

Classification Chart



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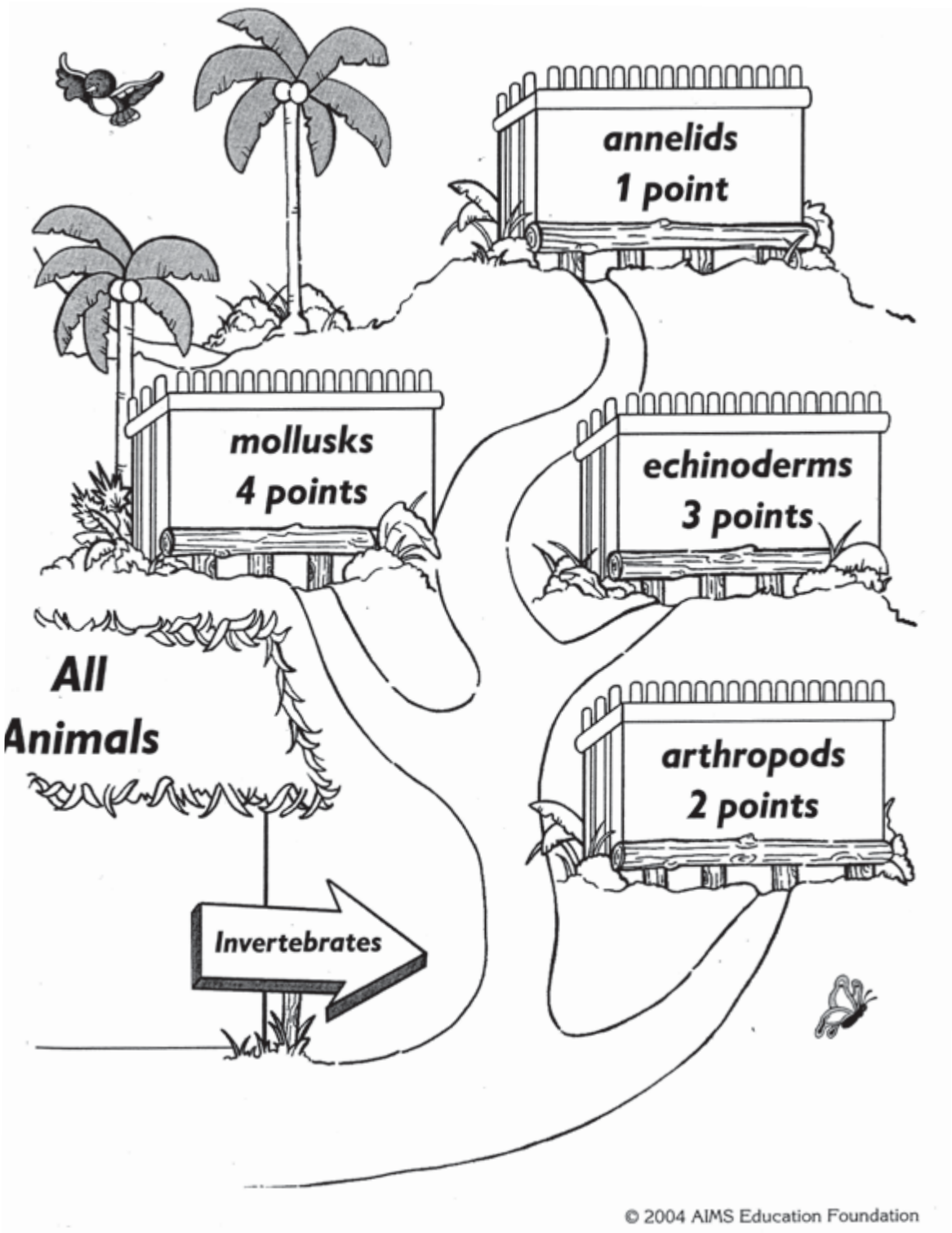
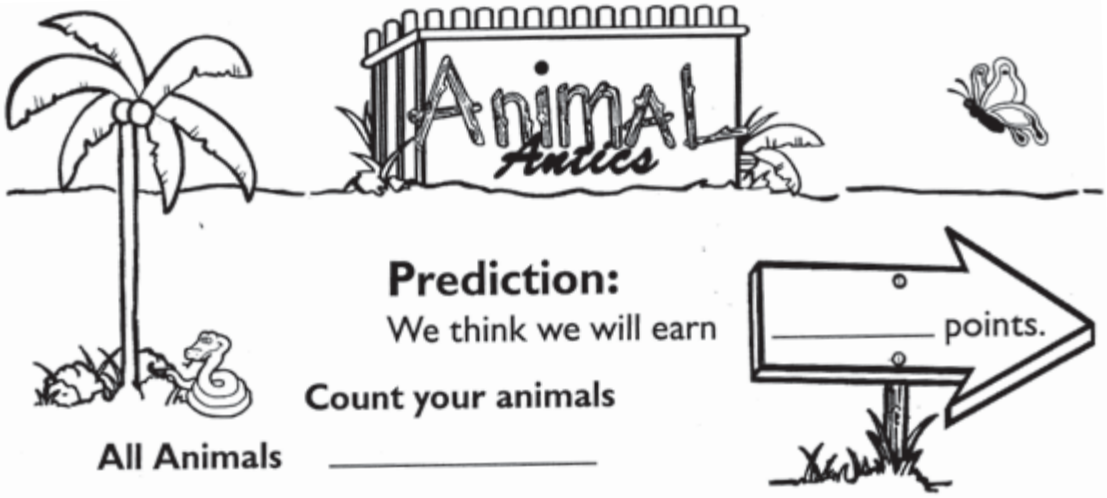
Animal Antics*

Classification Chart



Animal Antics*

Data Chart



Prediction:
We think we will earn _____ points.

Count your animals

All Animals _____

Vertebrates _____

Invertebrates _____

Kind of Animal	# of Animals			Points Earned
mammals	_____	x 1	=	_____
fish	_____	x 3	=	_____
birds	_____	x 2	=	_____
reptiles	_____	x 4	=	_____
amphibians	_____	x 5	=	_____
annelids	_____	x 1	=	_____
mollusks	_____	x 4	=	_____
arthropods	_____	x 2	=	_____
echinoderms	_____	x 3	=	_____

Team Total _____

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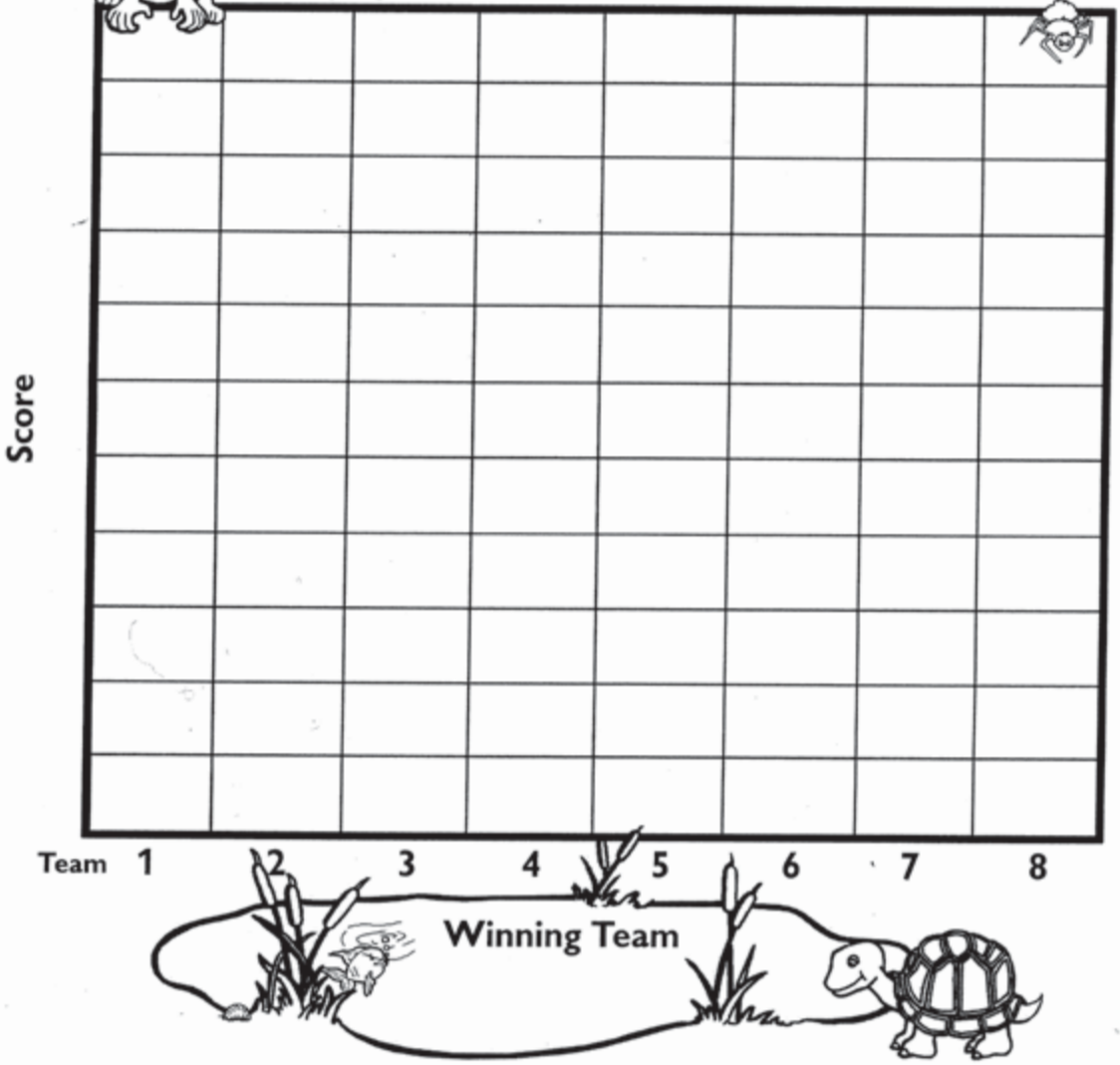
Animal Antics*

Graphing Sheet

Team	1	2	3	4	5	6	7	8
Score								

Now graph the scores:



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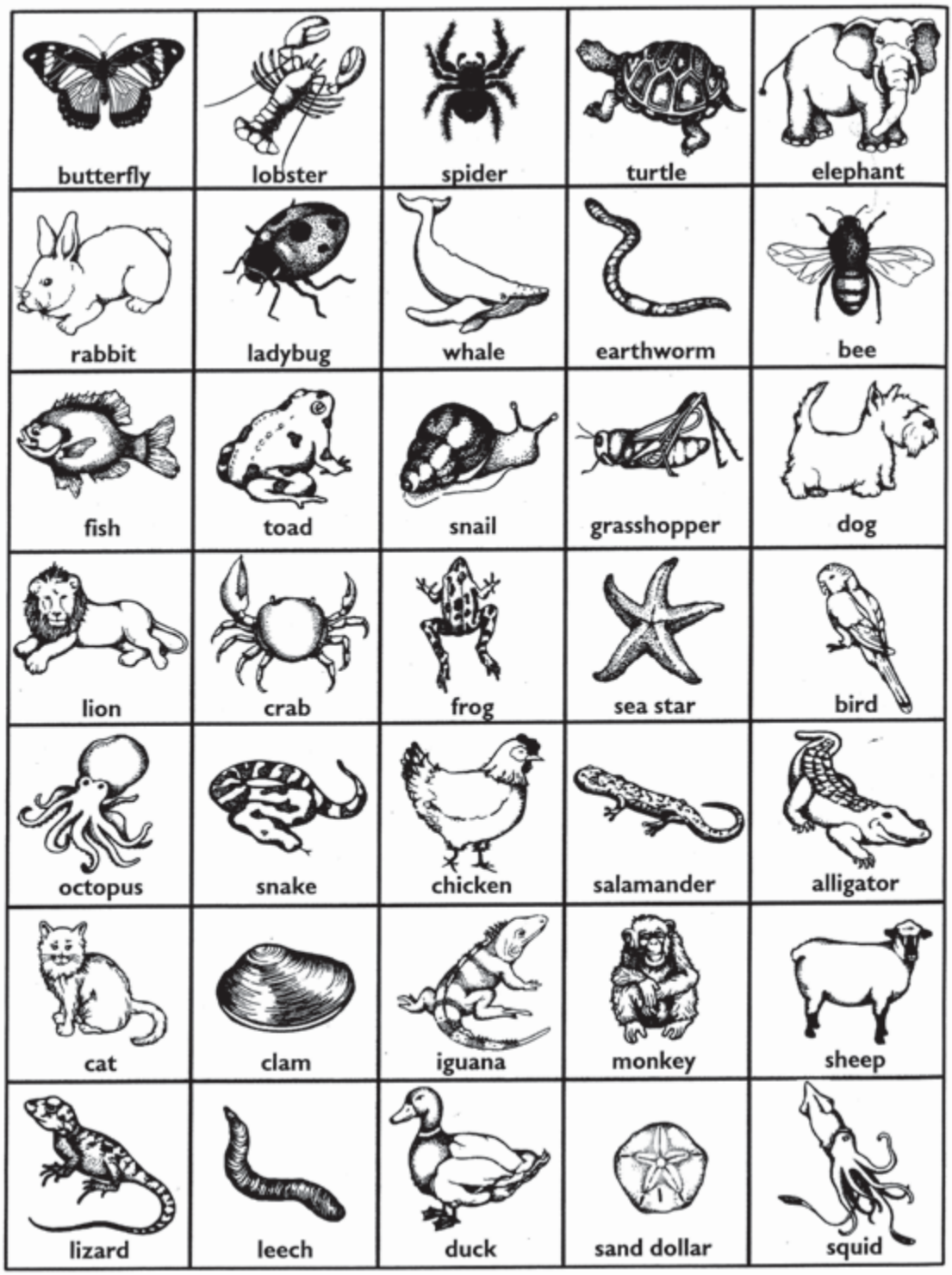
Animal Antics*

Animal Picture Sheet



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Di Means Two

Segment 1

Purpose

To learn how to use a dichotomous key

Background

Scientists can greatly simplify the identification of organisms by using a dichotomous key, an organized set of couplets that have mutually exclusive characteristics. You simply compare the characteristics of an unknown organism against an appropriate dichotomous key. These keys will begin with general characteristics and lead to more specific ones. If the organism falls into one category, you go to the next indicated couplet. By following the key and making the correct choices, you should be able to identify the organism. Couplets can be organized in several forms. Present the couplets by using numbers or letters (numeric key). You can also present them together or grouped by relationships (alphabetical key). There is no apparent uniformity in presentation for dichotomous keys.

Materials

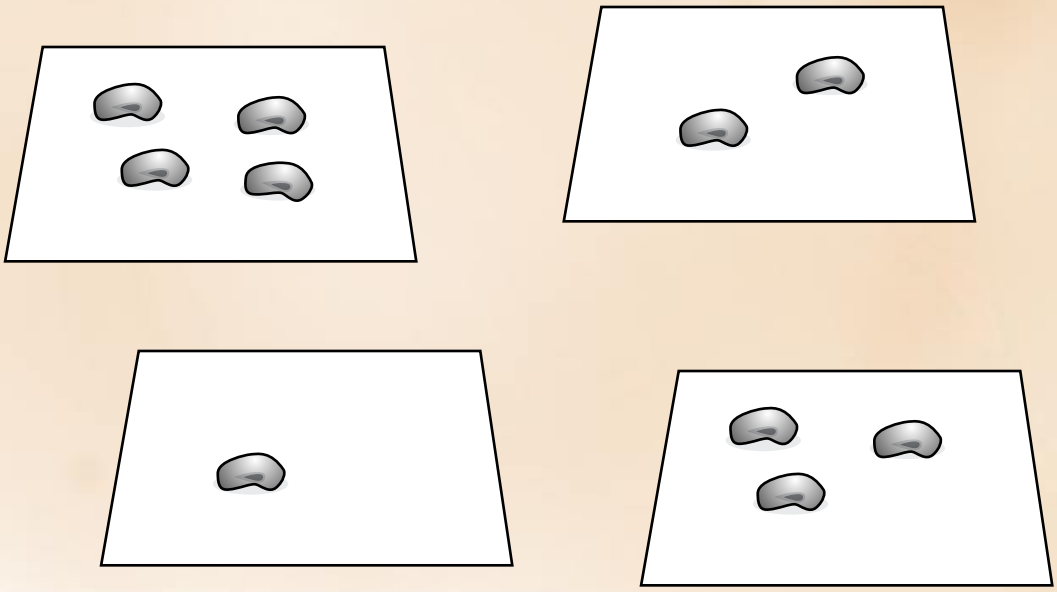
Per group

10 beans of each:
- kidney beans
- white northern beans
- pinto beans
- black beans

garbanzo beans
bowl
4 index cards
glue
marker

Procedure

1. Place five beans of each type in a bowl.
2. Choose one bean at a time and use the numeric key to identify the type of bean.
3. Go through the couplets by answering the questions correctly and proceeding to the next indicated couplet.
4. When you have correctly identified the bean, place it on an index card. Use a different index card for each type of bean.
5. Once all the beans have been identified, glue them onto the index cards and label each card with the correct name of the bean.
6. When you have finished, repeat the activity by using the remaining beans and the alphabetical key.



Di Means Two

Segment 1

Numeric Key

1a. Bean (round)	**garbanzo bean**
1b. Bean (elliptical or oblong)	Go to 2
2a. Bean (white)	**white northern**
2b. Bean (with dark pigments)	Go to 3
3a. Bean (evenly pigmented)	Go to 4
3b. Bean (pigmentation mottled)	**pinto bean**
4a. Bean (black)	**black bean**
4b. Bean (reddish-brown)	**kidney bean**

Alphabetical Key

A. Bean (elliptical or oblong)	Go to B
B. Bean has dark pigments	Go to C
C. Bean color is solid	Go to D
C. Bean color is mottled	**pinto bean**
D. Bean is black	**black bean**
D. Bean is reddish-brown	**kidney bean**
B. Bean is white	**white northern**
A. Bean is round	**garbanzo bean**

Conclusion

1. Which key was easier for you to use? Explain.
2. Why is it important to start out with general characteristics?
3. Why was it important for you to read both choices in a couplet before identifying the bean?
4. Were there any terms you didn't understand in either key? If so, what would you recommend?

Extension

Use household objects and create your own dichotomous key.

Cold-Blooded Bananas*

Segment 1

Purpose

To understand what it means to be cold-blooded

Teacher Note: To create a warm place in the room, use direct sunlight, a heater vent, sunlamp, or other available device. To create a cold place in the room, use a refrigerator, tub of ice, air conditioner, or other available device.

Materials

banana
2 identical thermometers
plastic knife or craft stick
hot area
cold area
Banana Data Sheet (p. 33)
toothpicks (optional)

Background

Cold-blooded (ectothermic) animals have no internal way of regulating their body temperatures. They are cool when their surroundings are cool and warm when their surroundings are warm. To maintain their body temperature within a range they can tolerate, cold-blooded animals may move to a warmer or cooler place. When their bodies are in contact with warmer or cooler surfaces, heat is transferred and their temperatures rise and fall. In extreme heat or cold, some animals burrow underground where the temperature is usually more moderate. Almost all animals are cold-blooded except for mammals and birds. Warm-blooded (endothermic) animals have a built-in automatic control system enabling them to have a consistent body temperature.

Procedure

1. Look at the thermometers and note the increments used to measure temperature. In the space provided on the side of the first banana graph on the Banana Data Sheet, write in the increments to "calibrate" or align the graph to the thermometer.
2. Use the plastic knife or craft stick to cut the banana into three pieces as equal in size as possible.
3. If toothpicks are provided, give each banana piece legs to create banana animals.
4. Use one thermometer to measure the room temperature.
5. Record the room temperature on the Banana Data Sheet by shading in the correct number of increments.
6. Insert the other thermometer into one of your banana animals and wait five minutes.
7. Record the temperature of the banana animal on the Banana Data Sheet.
8. Place one of the three banana pieces in a hot place and another in a cold place.
9. Wait one hour and then measure and record the room (air) temperature of the hot place.
10. Measure and record the temperature of the hot banana piece.
11. Repeat steps 9–10 with the cold banana piece.
12. Discuss your results.

Conclusion

1. Did the temperature of the banana pieces exactly match the surrounding air temperature? Why or why not?
2. Do you think cold-blooded (ectothermic) animals are having a harder time keeping warm or keeping cool today? Why? What might they be doing to meet their needs?
3. Would it make a difference if you kept the peel on the banana? Explain. How could you find out for sure?
4. What do aquatic (water) animals do to survive in a lake that freezes over?
5. What do desert animals do to survive the extreme heat?
6. Do you have any cold-blooded pets at home? If so, what are they and how do they regulate their body temperatures?

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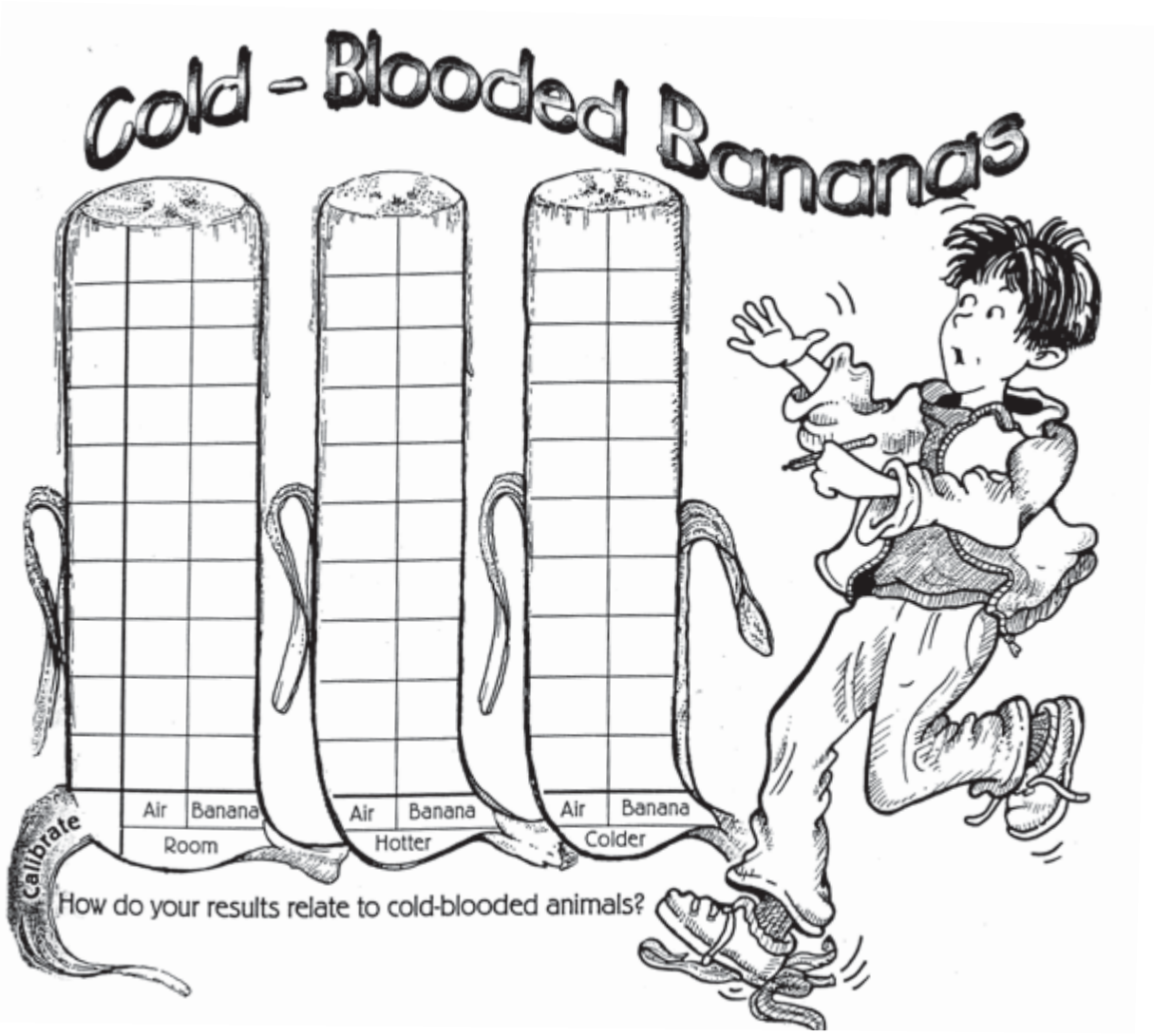
Cold-Blooded Bananas*

Segment 1



On a seperate sheet of paper, write number sentences to compare your data.

Example: The banana in the heat is _____ degrees warmer than the banana at room temperature.

Answer Key

Segment 1

Alike or Different?

1. Answers will vary.
2. Answers will vary.
3. Answers will vary but might include that one of the greatest challenges is the enormous diversity of animals.

Animal Antics

1-6. Answers will vary

Di Means Two

1. Answers will vary.
2. It is important to begin with general characteristics because it is easier to narrow the identification as you progress through the key and use more specific characteristics.
3. Although the first description may seem to fit your sample, the second one may apply even better.
4. Answers will vary. If students encounter difficulty using the terms in a dichotomous key, provide a glossary to avoid mistakes in identification.

Cold-Blooded Bananas

1. Answers will vary, but the temperature of the banana piece should have been close to the air temperature.
2. Answers will vary depending on the weather.
3. Yes, it might make a difference if the peel were kept on the banana. The peel can act as a type of insulation. To find out for sure, repeat the experiment, leaving the peel on the banana pieces.
4. Aquatic animals might stay in the somewhat warmer levels of the water or mud at the bottom.
5. Desert animals are usually active at night when it is cooler and stay sheltered during the day.
6. Answers will vary.