Taxonomy: Who is in my family?
Student Version

In this lesson, we will find out more about how organisms are classified into various groups by learning how to use a dichotomous key to identify specific species in a collection of different organisms.

Key Concepts/Vocabulary:

- **Biodiversity** is the variety (-diversity) of living organisms (bio-) in the world
- A **dichotomous key** is a flow chart with branches based on either/or decisions that can be used to arrive at distinct results at the ends
    - "Dichotomous" refers to the branching nature of the key, with each branch point splitting off into only 2 branches each time.
    - When used in the classification of organisms, either/or decisions are usually based on distinguishing physical features of the organisms being studied.
- The different levels of the **Linnaean classification system** are (in order of decreasing size): Domain/Kingdom/Phylum/Class/Order/Family/Genus/Species
  Domains are the highest level. Within domains are kingdoms, and within kingdoms are phyla, etc. Each unit/group at any level is called a **taxon** (e.g. Homo is a taxon at the genus level).
- A two-part naming system for organisms in Latin is known as **binomial nomenclature**. The first part of the name is the genus, and the second the species. An organism's name is usually italicized, with only the first letter of the genus capitalized - for example, the binomial nomenclature for humans is Homo sapiens.

Part 1 – Who's More Closely Related?

Organisms that have greater similarities to each other are more closely related than those which share only a few characteristics. In this activity, we will look at pictures of various organisms and put them into groups based on how they look, and attempt to figure out which organisms are more closely related.

For this activity, you will need:

- 20 different photograph cut-outs.

Procedure:

1. Lay out all 20 photograph cut-outs on the table so that you can see all of them.

2. Pick one organism and find other organisms that seem most similar to it. Put the photographs in this first group together, clearly separated from the other photographs. Try and do this on your own first, because we will be comparing results later on.

3. Write down the names of these organisms in the row for group 1 of the table A below. Names are found at the bottom of each photograph.

4. Write down what features are shared by the organisms you have put in group 1 in the table A. Be as detailed as possible in listing out all the reasons for why you have put these organisms in the same group.

5. Continue making more groups and filling up the table until you have put all 20 organisms into a group. You do not need to fill up all the rows provided in the table.

Table A: Observations and Groupings

Group No.	Group members (names of organisms)	Shared features
1		
2		
3		
4		
5		
6		
7		
8		
9		

Questions:

Q1. Compare your list of groups with your friends. Do the groups that you have made match with everyone else?

Yes / No

If no, why do you think people got different results?

Q2. Are there any big groups in your list which can be split into smaller groups?

Yes / No

If yes, which group can be split, and into what sub-groups? Do this for just one group which you think can be split.

Group No.: _____

Subgroup A members: _____

Subgroup A shared features: _____

Subgroup B members: _____

Subgroup B shared features: _____

Q3. Are there any small groups in your list which can be combined into one big group?

Yes / No

If yes, which groups can be joined, and what features do all members of the large group share? Do this for just one new large group which you think can be formed.

Large group members: _____

Shared features: _____

Q4. Are there any organisms that are difficult to place in one group? Which organisms are they and which groups do they seem to belong to?

Organism	*Possible Groups*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Q5. Are there organisms that have some similarities but have been placed in different groups? List down some of these organisms and their shared feature.

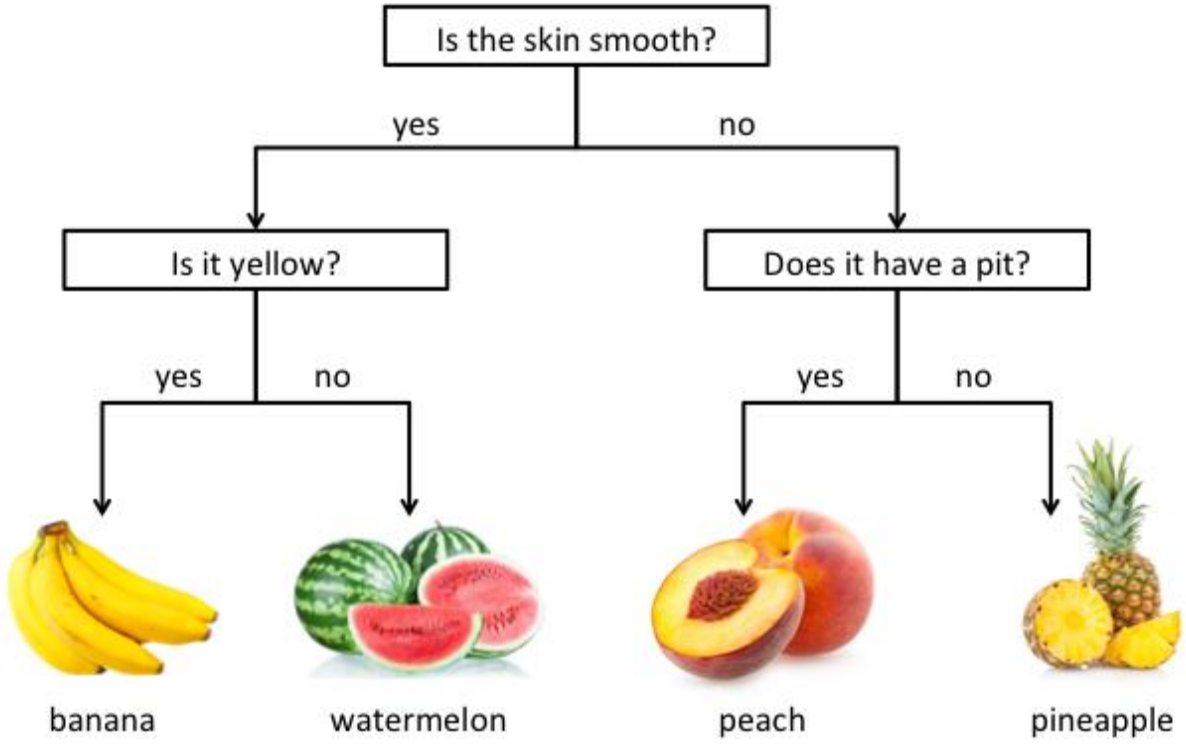
Shared Feature	*Organisms (and Group No.)*
_____	_____
	_____
_____	_____
	_____

Why do you think organisms in different groups can be distant from each other and yet have shared features?

Q6. What do you think all 20 organisms share in common?

Part 2a – Using a Dichotomous Key

In this activity, we will learn how to identify cartoon animals using a ***dichotomous key***. A dichotomous key is a reference chart that allows us to identify an organism through a series of questions about the organism with either/or answers (hence the term dichotomy, since it is a choice between two distinct options). A dichotomous key may be represented in various ways, the first of which is a tree diagram, where every branch point is a question, and it splits off into two branches depending on which of the two answers you choose. Here is an example of a dichotomous key for some types of fruit.. (Note: you could build many different keys to identify the same four fruits):



A dichotomous key may also be represented in the form of a "choose your own adventure" book, where a choice to one question brings you to either another question, or end in an answer. This does essentially the same thing as a tree diagram, but represents it in a very compact form. Here is a simple example of how it would compare with the tree diagram above:

1a. Skin of fruit is smooth …….(2)
1b. Skin of fruit is not smooth…….(3)

2a. Fruit is yellow……Banana
2b. Fruit is green ……Watermelon

3a. Fruit has a pit……Peach
3b. Fruit does not have pit……..Pineapple

Since our cartoon animals have already been discovered and characterized earlier, we will now use the dichotomous key provided to identify the set of cartoon animals that we have.

For this activity, you will need:

- 8 cartoon animals (Set A)
- Set A Dichotomous Key

Procedure:

1. Using the dichotomous key starting at 1a/b, determine whether 1a or 1b gives a better description of animal A1, and then follow the closer match to the next number specified.

2. Continue following the key in the same way, moving to subsequent numbers until you reach a name instead of a number.

3. Write down the scientific name you have arrived at for A1 in the space provided in table B. You have now identified A1 to be this particular species.

4. Repeat steps 1 and 2 with the other 7 animals to identify all 8 of them. Remember to always start using the key at step 1a/b.

Table B: Identities of Cartoon Animals in Set A

Cartoon Animal	Scientific Name
A1	
A2	
A3	
A4	
A5	
A6	
A7	
A8	

Questions:

Q7. Which animal do you think A8 is most related to and why?

Q8. Do you think a different key could be made to achieve the same end result of identifying all the cartoon animals?

Q9. What do you think makes a good dichotomous key?

Image sources:
Football: http://johnclay.bloginky.com/category/college-football/
Rugby ball: http://sportige.com/rugby-ad/
Soccer ball: http://us.7digital.com/cms/USEvents/World-Cup-2010.aspx
Basketball: http://www.principalspage.com/theblog/archives/tag/basketball

Part 2b – Drawing a Dichotomous Key

Having learned how to use a dichotomous key, we will now learn about how the dichotomous keys are made based on our observations. In this activity, we will use the skills we have learned from the previous two activities to construct our own dichotomous key for a new set of cartoon aliens.

For this activity, you will need:

- 8 cartoon aliens (Set B)
- Large drawing paper

Procedure:

1. Lay out the cut outs of cartoon aliens B1 to B8 on the table.

2. Examining all the aliens and their characteristics, divide the animals into two groups based on differences in one feature (e.g. number of legs). The groups do not need to be equal in size. Groups with only 1 alien in them are fine as well.

3. Draw a box for the feature at the top of your drawing paper, and show two branches coming out of it.

4. Label each branch (e.g. 6 legs or 8 legs).

5. Take one group to work on first. Find another feature that allows you to divide this group into 2 smaller groups (e.g. wings).

6. Draw in the next box for the second feature (e.g. if you took the 6 legs group, draw a box for "wings" that is joined to the branch for "6 legs" in your chart).

7. Continue doing this until you have each alien in its own group. You now have the honor of giving your newly classified cartoon aliens their own unique names!

8. When you are done, compare your key with a friend, or let a friend identify the aliens with your key.

Questions:

Q10. How many boxes have you drawn in your chart?

_____

Q11. Do you think you can draw your chart with fewer steps/boxes?

Yes / No

Q12. Is it better to have more boxes or fewer boxes? Why?

Q13. According to your chart, is B1 more closely related to B3 or B8?

_____

Q14. Are physical features sufficient for determining which aliens are most related to each other?

Yes / No

Q15. What are some other methods or things that we can compare to find out how closely related two animals, aliens or people are?