



Science Grade 06 Unit 11 Exemplar Lesson 02: Domains and Kingdoms

This lesson is one approach to teaching the State Standards associated with this unit. Districts are encouraged to customize this lesson by supplementing with district-approved resources, materials, and activities to best meet the needs of learners. The duration for this lesson is only a recommendation, and districts may modify the time frame to meet students' needs. To better understand how your district may be implementing CSCOPE lessons, please contact your child's teacher. (For your convenience, please find linked the TEA Commissioner's List of [State Board of Education Approved Instructional Resources](#) and [Midcycle State Adopted Instructional Materials](#).)

Lesson Synopsis

Students will identify the characteristics of organisms that classify them into the currently recognized Domains and Kingdoms. They will recognize the Domain as the broadest classification of organisms and understand the relationship between the Domains and Kingdoms based on characteristics used for the classification of organisms.

TEKS

The Texas Essential Knowledge and Skills (TEKS) listed below are the standards adopted by the State Board of Education, which are required by Texas law. Any standard that has a strike-through (e.g. ~~sample phrase~~) indicates that portion of the standard is taught in a previous or subsequent unit. The TEKS are available on the Texas Education Agency website at <http://www.tea.state.tx.us/index2.aspx?id=6148>.

6.12 *Organisms and environments. The student knows all organisms are classified into Domains and Kingdoms. Organisms within these taxonomic groups share similar characteristics which allow them to interact with the living and nonliving parts of their ecosystem. The student is expected to:*

6.12C Recognize that the broadest taxonomic classification of living organisms is divided into currently recognized Domains.

6.12D Identify the basic characteristics of organisms, including prokaryotic or eukaryotic, unicellular or multicellular, autotrophic or heterotrophic, and mode of reproduction, that further classify them in the currently recognized Kingdoms.

Supporting Standard

Scientific Process TEKS

6.2 *Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:*

6.2D Construct tables ~~and graphs, using repeated trials and means,~~ to organize data and identify patterns.

6.4 *Scientific investigation and reasoning. The student knows how to use a variety of tools and safety equipment to conduct science inquiry. The student is expected to:*

6.4A Use appropriate tools to collect, record, and analyze information, including journals/notebooks, ~~beakers, Petri dishes, meter sticks, graduated cylinders, hot plates, test tubes, triple beam balances,~~ microscopes, thermometers, ~~calculators, computers, timing devices,~~ and other equipment as needed to teach the curriculum.

GETTING READY FOR INSTRUCTION

Performance Indicators

Grade 06 Science Unit 11 PI 01

Classify organisms into their Domain and Kingdom by sorting cards with various organisms into the proper category. Include basic characteristics, such as cell structure, the manner in which food is synthesized, and the mode of reproduction. Complete a semantic feature map to display the results of the card sort.

Standard(s): 6.2D , 6.12A , 6.12B , 6.12C , 6.12D

ELPS ELPS.c.1C , ELPS.c.5B

Key Understandings

- Cell structure is used to classify organisms into Domains and Kingdoms.
 - How is cell structure used to classify organisms into taxonomic groups?
- Organisms can be classified and placed into Domains by their characteristics.
 - How are characteristics of organisms used to classify them into taxonomic groups?

Vocabulary of Instruction

- Domain
- Kingdom
- sexual reproduction
- asexual reproduction
- Archaeobacteria
- Eukarya
- Protista
- Fungi
- nucleus
- prokaryotic
- eukaryotic
- autotroph(ic)













- Archaea
- Eubacteria
- Plantae
- Animalia
- heterotroph(ic)

Materials

- markers (1 package per group)
- paper (poster, 1 per group)
- reference materials or campus based resources (per class)
- tape or glue (per class)

Attachments

All attachments associated with this lesson are referenced in the body of the lesson. Due to considerations for grading or student assessment, attachments that are connected with Performance Indicators or serve as answer keys are available in the district site and are not accessible on the public website.

-  [Teacher Resource: PowerPoint: Concept Attainment](#)
-  [Teacher Resource: Characteristics of Living Things Card Sort](#)
-  [Handout: Characteristics of Classification Notes](#)
-  [Teacher Resource: Characteristics of Classification](#)
-  [Teacher Resource: Organize This](#)
-  [Teacher Resource: Classification of Living Things](#)
-  [Teacher Resource: Who Am I](#)
-  [Teacher Resource: Guess Who](#)
-  [Handout: Taxonomy of Organisms](#)
-  [Teacher Resource: Taxonomy of Organisms KEY](#)
-  [Handout: Domains and Kingdoms](#)
-  [Teacher Resource: Domains and Kingdoms KEY](#)

Resources

- Suggested Websites:
 - Classification Web Quest: <http://mrscienceut.net/Classification.html>
 - Windows to the Universe: http://www.windows2universe.org/earth/Life/classification_intro.html
 - Educore: <http://educore.ascd.org/resource/LiteracyTemplate/a6c8d770-33d3-4b26-85f2-e7671b6d1601>
 - Biology4Kids: http://www.biology4kids.com/files/studies_kingdoms.html

Advance Preparation

1. Prior to Day 1: Print, laminate, cut apart, and bag sets of cards from the Teacher Resource: **Characteristics of Living Things Card Sort**. You need one set per group.
2. Prior to day 2:
 - Print the Teacher Resource: **Characteristics of Classification** (see Advance Preparation, 1 per 4 stations).
 - Print, laminate, cut apart, and bag sets of cards from the Teacher Resource: **Organize This**. You need enough sets for the maximum number of groups you will have in your classes.
 - Print the Teacher Resource: **Classification of Living Things** (see Advance Preparation, class set, 1 per pair of students)
 - Print, laminate, cut apart, and bag sets of cards from the Teacher Resource: **Who Am I**. You will need enough sets for the students to work in pairs.
3. Prior to Day 5:
 - Arrange for access to student computers/Internet and textbooks/other campus based resources for student research.
 - Print, laminate, cut apart, and bag sets of cards from the Teacher Resource: **Guess Who**. You will need one set for each group.
4. Prepare attachment(s) as necessary.

Background Information

Prior to this lesson, in elementary grades, students have studied external characteristics and inherited and learned traits of organisms in order to learn how organisms survive and interact with their environments. They have learned that some organisms produce their own food and some are dependent on other organisms for food. Students have also learned that energy flows from one organism to another in a food chain. Students will understand that the taxonomic system is based on understanding differences at the cellular level. Students were introduced to the concepts of cells in the previous lesson. During this lesson, students learn that the presence of a nucleus determines whether a cell is prokaryotic or eukaryotic which is used to classify organisms into Domains. Characteristics also studied in this unit will include autotrophs, heterotrophs, unicellular vs. multicellular organisms, and modes of reproduction which are used to classify organisms into Kingdoms. Students will gain an understanding of the broadest taxonomic

classifications of organisms and how characteristics determine their classification. After this unit, in Grade 7, students will study cell theory, function, and reproduction in greater depth. They will study cell organelles and differentiate between plant and animal cells.



Living organisms can be classified into three Domains: Archaea, Eubacteria, and Eukarya. These Domains are based primarily on the presence or absence of a nucleus. The Domains are further subdivided into Kingdoms. There are currently six Kingdoms. They include the Archaea (Archaeobacteria), Bacteria (Eubacteria), Protista, Fungi, Plantae, and Animalia

STAAR Note: This is an important foundational piece for the understanding of cells and cell theory. It is the first time that students have been directly introduced to the concept of organisms being composed of one or more cells. Although 6.12A is not marked as a Supporting Standard, it builds content for Supporting Standard 7.12F. 6.12B is also not marked as a Supporting Standard, although recognizing the presence of a nucleus as determination of prokaryotes or eukaryotes builds content for Supporting Standards 6.12D and 7.12D. Supporting Standards 6.12D, 7.12D, and 7.12F will be tested on STAAR Grade 8 under Reporting Category 4: Organisms and Environments.

For more information, please visit the following sites:

- http://www.windows2universe.org/earth/Life/classification_intro.html
- <http://educore.ascd.org/resource/LiteracyTemplate/a6c8d770-33d3-4b26-85f2-e7671b6d1601>
- http://www.biology4kids.com/files/studies_kingdoms.html

INSTRUCTIONAL PROCEDURES

Instructional Procedures ENGAGE/EXPLORE – Concept Attainment – Classification	Notes for Teacher NOTE: 1 Day = 50 minutes Suggested Day 1
<ol style="list-style-type: none"> 1. Divide students into competitive teams to solve the “mystery”. The teacher may allow the groups to collaborate throughout the activity by whispering or may decide to only allow collaboration at the end of the presentation of examples. 2. Say: <ul style="list-style-type: none"> • Today, I am going to introduce to you a “mystery” concept. I am going to show you examples and non-examples of the “mystery” concept. After the examples are presented, it is up to your team to list the characteristics of the concept. Are there any questions? • This is a competition, so you will need to be very quiet when discussing your ideas so other teams do not hear your conversations. I’ll give you a hint: think about vocabulary from the last unit. • Record any notes in your notebooks. 3. Present the examples to the students using the PowerPoint: Concept Attainment. The teacher should report to students only that the picture is an example (yes) or a non-example (no) of the concept. 4. Do not add any words. Allow students time to think. You may want students to be silent through this part of the activity to allow time for processing. 5. At the end of the presentation of examples, allow students to ask clarifying questions. If a group thinks that they know what the concept is, allow them to share it with the class. If it is wrong, redirect their thinking. If it is right, congratulate the group and write the concept “autotroph” on the board or overhead. 6. Instruct students to work together to compile a list of attributes or characteristics for “autotroph” in their notebooks and share them with the class. Display all of the attributes or characteristics for all students to see. 7. Now, move to the non-examples. What is the concept expressed by all of the non-examples? Allow the groups to answer. The desired concept is “heterotrophic”. Instruct students to list and share attributes characterized by the concept “heterotrophic”. 8. Repeat the above process with the second set of concepts for multi-cellular/unicellular and prokaryote/eukaryote. 	<p>Attachments:</p> <ul style="list-style-type: none"> • Teacher Resource: PowerPoint: Concept Attainment <p>Instructional Notes: The purpose of concept attainment is to build background knowledge of concepts through repeated examples and non-examples of a concept. You may wish to add additional examples and non-examples to the PowerPoint in order to meet the specific needs of your students.</p> <p>In concept attainment, students determine the attributes or characteristics of a group or category set by the teacher.</p> <p>Once attributes are formed, a general definition of the concept can be outlined. Concept attainment is a beneficial way to introduce new concepts. This process introduces students to multiple representations of the concepts. It can also connect prior knowledge of concepts to new ideas.</p> <p>The PowerPoint: Concept Attainment contains three concepts:</p> <ul style="list-style-type: none"> — autotrophs/heterotrophs — multicellular/unicellular — prokaryote/eukaryote <p> Check For Understanding: The Engage activity serves to assess whether or not students are transferring concepts learned in Lesson 01 to Lesson 02. Note any discrepancies, and address them immediately, as students will have to apply these concepts to the classification of organisms.</p> <p> Science Notebooks: Students record notes in their notebooks.</p>
<p>EXPLORE/EXPLAIN – Sexual and Asexual Reproduction</p> <ol style="list-style-type: none"> 1. Keeping students in the same groups, distribute a set of cards from the Teacher 	<p>Suggested Day 1 (Continued)</p> <p>Attachments:</p>

Resource: **Characteristics of Living Things Card Sort** (see Advance Preparation) to each group.

2. Instruct students to match the terms to the descriptions and then, use their notes from their science notebooks to check for accuracy.
3. Students have seen most of the terms in the previous lesson, but sexual reproduction and asexual reproduction are new and the students will have to guess.
4. Monitor and assist students as needed while they match the cards.
5. Once students match the cards,
Ask:
 - **Are there any words that you have not studied before?** *Sexual reproduction and asexual reproduction*
 - **Which card do you think goes with sexual reproduction?** *Two parents*
 - **What do you think asexual means?** *There is only one parent.*
6. Say:
 - **All of the terms that you have on your desk are characteristics of organisms that allow scientists to classify (organize) them into groups. We have learned about all of the terms in our previous lesson, except for sexual reproduction and asexual reproduction.**
 - **Sexual reproduction is the ability of an organism to make offspring (babies) and pass down its genetic code. Some of the characteristics of the mother and some characteristics of the father are given to the offspring. The offspring (babies) look similar to the parents, but not identical. Most organisms, including humans, reproduce like this.**
 - **Asexual reproduction is the ability of an organism to produce offspring (babies) and pass down its genetic code, but only one parent is needed. The offspring will receive the traits from only one parent so the offspring will be identical to the parent. In other words, they are able to clone themselves. Examples of organisms that reproduce asexually are starfish and tapeworms. The prefix “a” means “without”. Therefore, asexual means without sex.**
7. Collect card sets.
8. Instruct students to record the definition of sexual and asexual reproduction in their notebooks and give examples of each. (Students may need assistance unless reference materials are available.)

- Teacher Resource: **Characteristics of Living Things Card Sort** (see Advance Preparation, 1 set per group)



Science Notebooks:

Students define sexual and asexual reproduction and list examples of each.

EXPLAIN/EXPLORE/EXPLAIN – Classification of Living Things

Suggested Days 2 and 3

1. Begin the class with a quick review of important characteristics of cells.
Ask:
 - **If you were given a box of silverware that was mixed up and you needed to set the table, what would make it easier?** *By separating the spoons, forks, and knives*
 - **What characteristics would help you identify a spoon, knife, or fork?** *The appearance*
 - **Would you put a teaspoon and tablespoon in the same pile?** *No, because they have different uses. (Students may need to see examples.)*
 - **So, what would you do with spoons of two different sizes?** *Make a separate pile.*
 - **Would you put a steak knife and butter knife in the same pile?** *No, make a new pile, but place them close together. (Students may need to see examples.)*
2. Inform students that they will be rotating through stations at the teacher's signal to read short passages on the characteristics used to classify organisms into groups.
3. Distribute the Handout: **Characteristics of Classification Notes** to each student.
4. Divide students into groups of 3–4.
5. Instruct students to rotate through stations to read passages from the Teacher Resource: **Characteristics of Classification** (see Advance Preparation) and complete their handouts.
6. Monitor and assist students as needed.
7. At the end of the reading rotation, display the correct answers for students to check



Materials:

- tape or glue (per class)

Attachments:

- Handout: **Characteristics of Classification Notes** (1 per student)
- Teacher Resource: **Characteristics of Classification** (see Advance Preparation, 1 per 4 stations)
- Teacher Resource: **Organize This** (see Advance Preparation, 1 set per group)
- Teacher Resource: **Classification of Living Things** (see Advance Preparation, class set, 1 per pair of students)

Instructional Notes:

Many students may not be familiar with formal names of utensils.

Duplicate stations to accommodate class size.



Science Notebooks:

their work.

Ask/Say:

- **Why would it be helpful to organize items?** *Organizing items makes it easier to find and use objects.*
- **Where in the school or community have you seen items organized?** *Libraries and grocery stores*
- **Scientists like to classify the different organisms of the world to make it easier to study them.**
- **What are the four characteristics that scientists use to classify organisms that we read about today?** *Number of cells, presence of a nucleus, how organisms get energy, and how an organism reproduces*

8. Instruct students to affix their notes to their notebooks.

9. Divide students into groups of 3–4. (You may wish to keep the same group for a time saver.)

10. Distribute a card set of the Teacher Resource: **Organize This** (see Advance Preparation) to each group. Instruct students to sort the cards into groups based on the pictures and the information written on the card.

11. Say:

- **Today, you and your group members will use the information written on the cards and pictures to classify these organisms just like you would if it were silverware.**
- **You can make as many groups as you want, with as many organisms as you want in each group.**
- **You need to come up with a title for each group and be able to justify why the organisms were grouped together.**

12. Allow students time to sort the cards into groups. Monitor and assist students by asking Guiding Questions. Help students break large groups down into smaller groups when possible. (*Students should ultimately create six groups and not have more than three cards in each group. The groups created will eventually become the Kingdoms.*)

13. Allow students an opportunity to share the titles of the groups, the organisms in each group, and why they were classified together with the whole class.

14. Reveal and display the correct grouping to students, and ask them to arrange their cards accordingly.

15. Instruct the students to copy down the titles of each group and the names of organisms in each group in their notebooks for future reference.

16. Ask:

- **What criteria did you use to help you organize your cards?** *Number of cells, presence of a nucleus, method of gaining energy, type of reproduction, and physical appearance*

17. Collect the card sets.

18. Post the following questions, and inform students that they are to use them as a guide to what is important when they read a passage with a partner. Inform them that they should be prepared to discuss the answers with the class.

- **What does the word classification mean?**
- **What does the word taxonomy mean?**
- **Who was the first person known to classify living things scientifically?**
- **Who came up with the modern classification system?**
- **What are the eight levels of classification?**
- **Which two levels of classification will be the focus of our lesson?**

19. Divide students into pairs.

20. Distribute a copy of the Teacher Resource: **Classification of Living Things Part 1** (see Advance Preparation) to each pair of students and instruct them to read Part 1 silently. Students may record notes in their notebooks if they wish.

21. Facilitate a discussion based on the posted questions:

Ask/Say:

- **What does the word classification mean?** *The process of grouping things based*



Students affix the completed Handout: **Characteristics of Classification Notes** to their notebooks.

Students construct a table and record the names of their groups and the organisms in each group from the card sort.

Students may record notes from their reading in their notebooks.

on similarities

- **What does the word taxonomy mean?** *The scientific study of how living things are classified*
- **Who was the first person known to classify living things, scientifically?** *Aristotle*
- **Who came up with the modern classification system?** *Carolus Linnaeus*
- **What are the eight levels of classification?** *Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species*
- **Which two levels of classification will be the focus of our lesson?** *We are only going to focus on classifying organisms by Domain and Kingdom.*

22. Collect reading passages from students.

EXPLAIN – Domains and Kingdoms

1. Divide students into pairs, and distribute a set of cards prepared from the Teacher Resource: **Who Am I** (see Advance Preparation) to each one. Instruct students to read the cards and match the clue with the term.
2. Monitor and assist students by asking Guiding Questions.
3. Review the matches with the class to check for understanding.
Ask:

- **Why do scientists use classification systems for organisms?** *They make it easier to study them.*
- **How do these terms help scientists classify the organisms?** *They use these characteristics to separate them.*

4. Collect the card sets.
5. Draw a large rectangle across the top of the board. Inform students that the rectangle represents every one of every kind of organism on Earth. Divide the rectangle into three sections: Archaea (about 4% of the organisms), Eubacteria (about 7% of all species), and Eukarya (89% of all species on Earth). Note: Assist students in visualizing the number of organisms in each Domain by increasing the section of the rectangle and size of the Domain font.

Archaea	Eubacteria	Eukarya
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6. Discuss some of the numbers for each group. Include the following:
Say:
 - **All living things are classified into three Domains.**
 - **The Domain is the broadest category of classification.**
 - **There are estimated to be about 1 million types of Eubacteria of which only 4,000 have been identified.**
 - **It is believed that there are about 600,000 Archaea species.**
 - **In the Eukarya Domain, there are about 12.4 million species.**
7. Post the following questions, and inform students that they are to use them as a guide to what is important during the reading of a passage. Inform them that they should be prepared to discuss the answers with the class.
 - **Which cell structure is used to classify organisms into Domains?**
 - **What specific characteristics will be most helpful in classifying organisms into their Domains?**
8. Divide students into pairs, and distribute Teacher Resource: **Classification of Living Things** Part 2 (see Advance Preparation) to each one.
9. Ask for volunteers to read each section of the “Domains” page, and remind students to focus on the Guiding Questions as they listen. Allow students to record notes if they wish.
10. After reading, facilitate a discussion based on the Guiding Questions.
Ask:
 - **Which cell structure is used to classify organisms into Domains?** *The nucleus*
 - **What specific characteristics will be most helpful in classifying organisms into their Domains?** *The presence of an organized nucleus puts organisms into the Domain Eukarya. The Archaea and Eubacteria are made up of organisms that*

Suggested Days 3 (continued) and 4

Attachments:

- Teacher Resource: **Who Am I** (see Advance Preparation, 1 set per pair of students)
- Teacher Resource: **Classification of Living Things** (from previous activity) (see Advance Preparation, class set, 1 per pair of students)

 **Misconception:**

- Students may think that behavior and habitat are criteria for classification.

 **STAAR Notes:**

This is the first time students have been introduced to taxonomic classification.

This SE contains new concepts for the students, and they are not directly taught again before the STAAR test is given in Grade 8.

Supporting Standards 6.12D, 7.12D, and 7.12F will be tested on STAAR Grade 8 under Reporting Category 4: Organisms and Environments.

 **Check For Understanding:**

Use student summaries as an informal assessment to determine student level of understanding.

 **Science Notebooks:**

Students record the characteristic that separates organisms into the different Domains (the presence of a nucleus and Eukarya=Nucleus and Eubacteria and Archeabaea=No Nucleus).

Students create tables in their science notebooks to illustrate the classification system for Domains and Kingdoms.

Additionally, students will add examples to each Kingdom using the given articles.

Students compare and contrast modes of reproduction in their notebooks.

are prokaryotes so they do not have the presence of an organized nucleus and are separated by their environments. Archaea are able to live in more extreme environments. There are other differences that you may learn about in later grades.

- Instruct students to create a table in their science notebooks to identify the characteristics of each Kingdom. Instruct students to label the Domains, and add the "Environment" characteristic on the table to distinguish between Eubacteria and Archaea. They can shade in this row for Eukarya

Domains	Archaea	Eubacteria	Eukarya		
Kingdoms					
Nucleus					
# of Cells					
Energy					
Reproduction					
Environment					
Examples					

- Say:

- Scientists further divide the three Domains into groups called Kingdoms. Scientists look at four characteristics to determine the Kingdom in which an organism belongs.

- Ask students to look at the **Classification of Living Things Part 2 Kingdoms Page** with you. Point out the six currently recognized Kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, and Animalia) and assist students in adding them to their tables.

Domain	Archaea	Eubacteria	Eukarya			
Kingdom	Archaeobacteria	Eubacteria	Protista	Fungi	Plantae	Animalia
Nucleus						
# of Cells						
Food						
Reproduction						
Environment						
Examples						

- Review and discuss the four characteristics used for classification of organisms:

- Presence of a nucleus (prokaryotic/eukaryotic)
- Number of cells (unicellular/multicellular)
- How they obtain food (autotroph/heterotroph)
- How they reproduce (asexual/sexual)

- Instruct students to work with their partner and use the information on the **Classification of Living Things Part 2 Kingdoms Page** to complete the remainder of the table:

Domain	Archaea	Eubacteria	Eukarya			
Kingdom	Archaeobacteria	Eubacteria	Protista	Fungi	Plantae	Animalia
Nucleus	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
# of Cells	Unicellular	Unicellular	Both	Mostly Multicellular	Multicellular	Multicellular
Food	Both	Both	Both	Heterotroph	Autotroph	Heterotroph
Reproduction	Asexual	Asexual	Both	Both	Mostly Sexual	Sexual
Environment						
Examples						

- Ask students to share out with the class and support their answers with evidence from the passage.
- Review the mode of reproduction as a characteristic for classification by asking students to compare and contrast sexual and asexual reproduction in their notebooks.
- Ask students to analyze the difference between Archaeobacteria and Eubacteria. *The environments in which they live are the only noted difference.*

Domain	Archaea	Eubacteria	Eukarya			
Kingdom	Archaeobacteria	Eubacteria	Protista	Fungi	Plantae	Animalia
Nucleus	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
# of cells	Unicellular	Unicellular	Both	Mostly Multicellular	Multicellular	Multicellular
Food	Both	Both	Both	Heterotroph	Autotroph	Heterotroph
Reproduction	Asexual	Asexual	Both	Both	Mostly Sexual	Mostly Sexual
Environment	Extreme Environment	Moderate Conditions				
Examples						

19. Refer students to their notebooks, and allow time to add any examples from previous activities.

20. Ask:

- **How are characteristics used to classify organisms into groups?** *The presence of a nucleus, the number of cells, how the organism obtains food, and the mode of reproduction are used to classify organisms into Domains and Kingdoms.*
- **How is cell structure used to classify organisms into groups?** *The presence of a nucleus is used to classify organisms into Domains.*

21. Collect reading passages from students.

ELABORATE – Domain and Kingdom Projects

Suggested Days 5 and 6

1. Divide students into groups of 4–6, and distribute the card sets from the Teacher Resource: **Guess Who** (see Advance Preparation) to each group.
2. Instruct students to select and read a clue card, and match the clue with the different characteristics. Once the students have collected all of the characteristics that go with the clue card, they will need to match this with the correct Kingdom card. (*The characteristic cards will be reused for each match.*)
3. It may be best to model this with an example. You can use the example provided in the picture or simply read a clue card with the class and instruct the students to follow along with their cards as you do the activity.

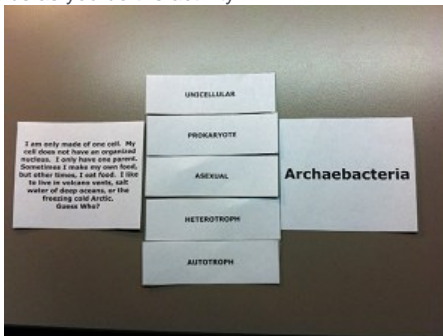


Image courtesy of L. Owens

4. Remind students to use the tables in their notebooks, from the day before, to assist them with the activity.
5. Monitor and assist students by asking Guiding Questions.
6. When the activity is complete, check the cards to make sure they are in the correct group. (*The characteristic cards will be reused for each match. Therefore, the teacher will need to monitor and check each group for accuracy before allowing them to move on to the next clue.*)

7. Ask:

- **How did the characteristics of the Domain help you match the clue to the correct Kingdom?** *First, the presence of an organized nucleus is used to separate organisms into Domains. The characteristics of each Kingdom are different. Only organisms with specific characteristics can fit into a certain Kingdom.*

8. Refer students to their notebooks where they recorded the organisms the grouped together from the Teacher Resource: **Organize This**.

Ask:

- **Which group titles did you come up with that are similar to the names of the Kingdoms?** Answers may vary.



Materials:

- reference materials or campus based resources (per class)
- paper (poster, 1 per group)
- markers (1 package per group)

Attachments:

- Teacher Resource: **Guess Who** (see Advance Preparation, 1 set per group)
- Handout: **Taxonomy of Organisms** (1 per group)
- Teacher Resource: **Taxonomy of Organisms KEY**

Instructional Notes:

The poster may be done as a multimedia project. One example of a technology-based poster would be through the use of Glogster.

9. Instruct students to write the correct Kingdom name next to the group title they created.
10. Collect card sets.
11. Keeping the same groups, distribute the Handout: **Taxonomy of Organisms** to each group.
Say:
 - **You and your partners will be researching six different organisms. Each group member will be responsible for answering four main questions about their organism to determine its characteristics and filling in their portion of the chart.**
 - **The four questions are:**
 - A. Is my organism eukaryotic or prokaryotic?
 - B. Is my organism autotrophic or heterotrophic?
 - C. Does my organism reproduce sexually or asexually?
 - D. Is my organism unicellular or multi-cellular?
 - **Once you have filled in the chart on your handout, compare it to the table we created yesterday to determine what Kingdom and Domain your organism belongs to.**
12. Divide the class into new groups based on organisms (six total groups based on the six different organisms being researched). Instruct each group to collaboratively make a poster for their organism using the information gained through their research and listed on the **Taxonomy of Organisms** handout.
13. Check the groups' posters for accuracy using the Handout: **Taxonomy of Organisms KEY**.
14. Allow groups to share their posters with the class.
15. Ask:
 - **What allows scientists to classify organisms?** *The four main characteristics (presence of nucleus, mode of reproduction, number of cells, how they obtain energy).*
 - **What is the difference between a Kingdom and a Domain?** *Domains include a much larger group of organisms. These groups are separated by whether or not an organized nucleus is present. A Kingdom is much more specific and it takes the combination of several characteristics to group these organisms.*

EVALUATE – Performance Indicator

Suggested Day 7

Grade 06 Science Unit 11 PI 01

Classify organisms into their Domain and Kingdom by sorting cards with various organisms into the proper category. Include basic characteristics, such as cell structure, the manner in which food is synthesized, and the mode of reproduction. Complete a semantic feature map to display the results of the card sort.

Standard(s): [6.2D](#) , [6.12A](#) , [6.12B](#) , [6.12C](#) , [6.12D](#)

ELPS [ELPS.c.1C](#) , [ELPS.c.5B](#)

1. Present the Performance Indicator expectations to students. Answer any questions they may have.
2. Divide students into groups of 3–4.
3. Distribute the card sets from the Teacher Resource: **Organize This** to each group and the Handout: **Domains and Kingdoms** to each student.
4. Instruct student groups to sort the cards into groups based on the picture and information on the card.
5. After sorting the cards into groups, instruct students to individually complete the semantic feature map section of the Handout: **Domains and Kingdoms**.
6. Students may use their science notebooks to help them with this activity.

Attachments:

- Teacher Resource: **Organize This** (from previous activity) (1 set per group)
- Handout: **Domains and Kingdoms** (1 per student)
- Teacher Resource: **Domains and Kingdoms KEY**

Instructional Notes:

Semantic feature maps are used to examine the similarities and differences of a group of items, people, events, etc. This type of map or chart is often used to compare and contrast characteristics and for simple logic puzzles.

Semantic feature maps display whether an item has or doesn't have each characteristic. A plus (+), minus (-), or checkmark is generally used, but a simple rating system (1, 2, 3) may also be used.

This type of map can be used to [compare and contrast the major characteristics of Kingdoms](#).



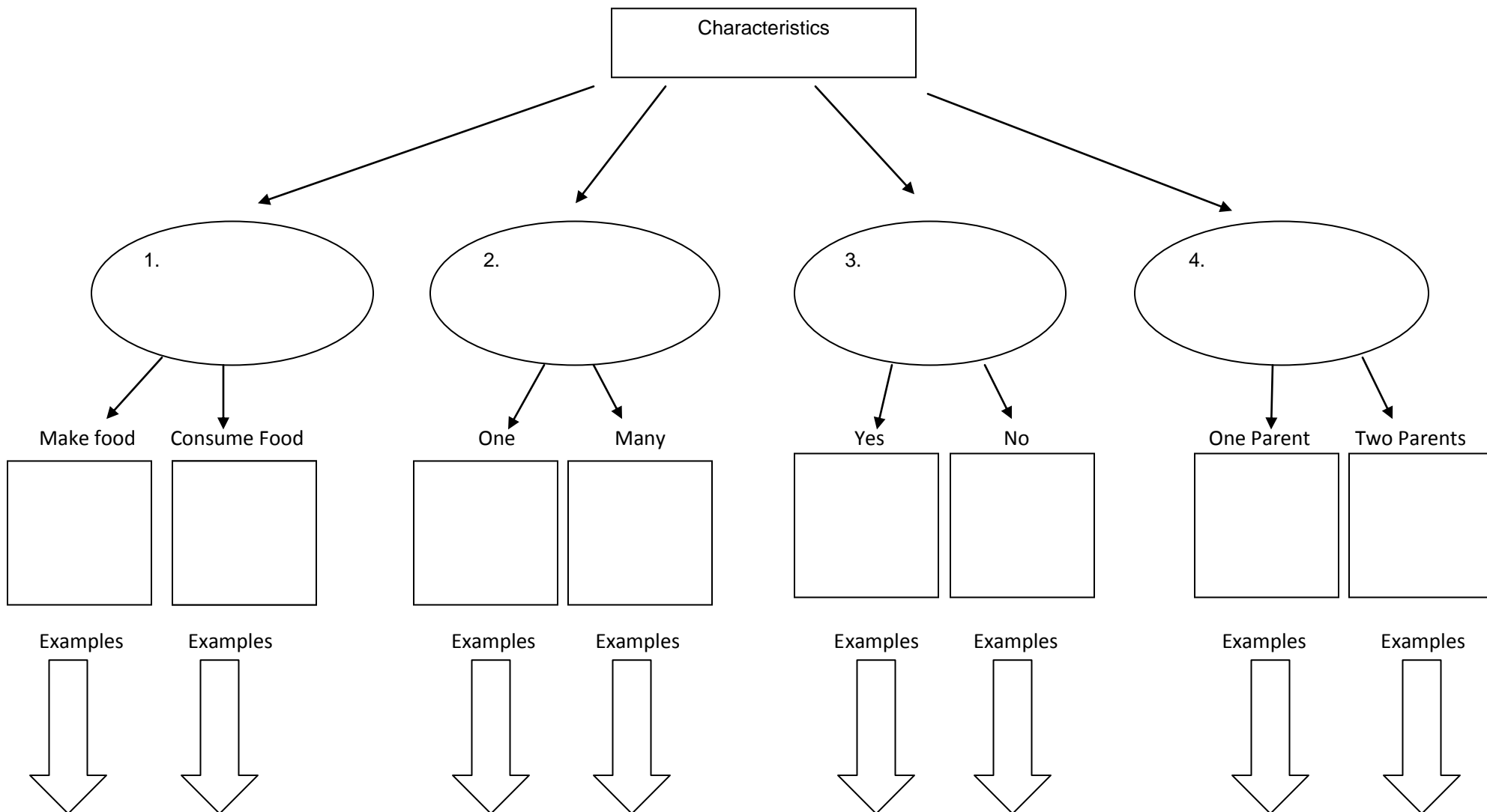
Science Notebooks:

Allow students to use previous notes from their science notebooks.

Characteristics of Living Things Card Sort

Prokaryote	Eukaryote	Sexual Reproduction	Asexual Reproduction
Heterotroph	Autotroph	Multicellular	Unicellular
Consumes Food	Makes Its Own Food	One Parent	Two Parents
One Cell	More than One Cell	Organized Nucleus	No Organized Nucleus

Characteristics of Classification Notes



Characteristics of Classification

1. How Organisms Get Energy

Autotrophs

Organisms that make their own food are called **autotrophs**. **Auto-** means “self”, and **-troph** means “feeder.” Therefore, an **autotroph** is a self-feeder. They use the food they make as an energy source to carry out their life functions. Examples are plants that make their own food by transforming the radiant energy from the Sun to chemical energy through the process of photosynthesis. **Autotrophs** are also known as **producers**. Some bacteria are **autotrophs**. They use chemicals in their environment to make their own food. Some Protists, such as Euglena, can make their own food. They contain a structure called a chloroplast, and they use sunlight for photosynthesis.



Heterotrophs

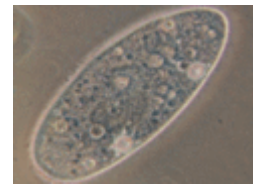
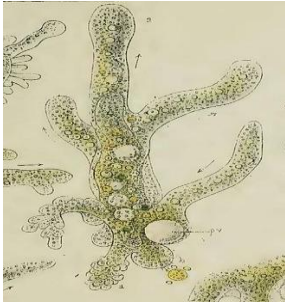
Organisms that cannot make their own food are called **heterotrophs**. **Hetero-** means “other” and **-troph** means “feeder”. A **heterotroph** must feed off of others. They get their energy from eating autotrophs (plants) or eating other heterotrophs. Examples are animals, mushrooms, and molds. Euglena are able to consume food when light is not present. Heterotrophs are also known as **consumers**. **Heterotrophs** transfer the chemical energy from food into other forms of energy they can use.



2. Number of Cells

Unicellular Organisms

All organisms are composed of cells. **Unicellular** organisms are single-celled (one). **Uni** = “one”. This one cell carries out all of the functions necessary to keep the organism alive. Bacteria are examples of unicellular organisms. Many Protists are **unicellular** as well.



Multicellular Organisms

All organisms are composed of cells. **Multicellular** organisms are made of many cells. **Multi** = “many”. All of the different cells are specialized to do certain tasks. Humans have skin cells, brain cells, and blood cells, just to name a few. Animals and plants are examples of **multicellular** organisms. Most Fungi are **multicellular**, and a few Protists are as well.



3. Presence of a Nucleus

Prokaryotic Cells

All organisms are made of cells which carry on the functions necessary to sustain life. A cell is the basic unit of structure and function in an organism. Just as our bodies are made up of many structures (parts) that work together, cells have many structures (parts) that do the same. The structure is the parts it is made of and how it is put together. The function is the job each structure performs. Organisms called **Prokaryotes** do **not** have an organized structure called a **nucleus** that contains genetic material and controls the cell. The genetic material just floats around inside of the cell. **Pro** = “before” and **karyote** = “nucleus”, no nucleus. You can remember that *Pro* rhymes with *No* for “NO” nucleus. Bacteria are examples of **prokaryotes**.



Eukaryotic Cells

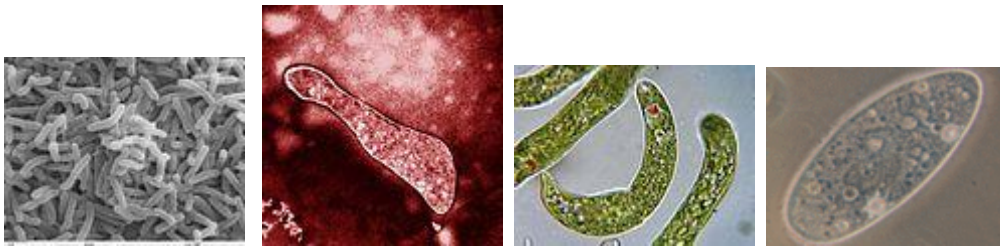
All organisms are made of cells which carry on the functions necessary to sustain life. A cell is the basic unit of structure and function in an organism. Just as our bodies are made up of many structures (parts) that work together, cells have many structures (parts) that do the same. The structure is the parts it is made of and how it is put together. The function is the job each structure performs. Organisms called **Eukaryotes** do have an organized structure called a **nucleus** that contains genetic material and controls the cell. **Eu** = “true” and **karyote** = “nucleus”, true nucleus. You can remember that *Eu* rhymes with *true* and *nu*. Animals, plants, Fungi, and Protists are examples of **eukaryotes**.



4. How an Organism Reproduces

Asexual Reproduction

Genetic material is passed from parents to offspring (babies) during reproduction. **Asexual reproduction** is a process that only involves one parent, not two. **A** = “not”, **not** sexual. The offspring will be identical to their parent. The genes of the offspring are exactly like the parent’s genes. Bacteria are examples of organisms that reproduce **asexually**. Bacteria will divide in half to form two cells identical to the original cell. This is called fission. Some plants, Fungi, and Protists can reproduce **asexually**. In rare instances, there are animals such as the sea anemone that can reproduce **asexually**.





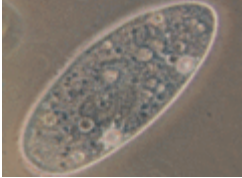












Sexual Reproduction

Genetic material is passed from parents to offspring (babies) during reproduction. In **sexual** reproduction, offspring result from the combination of genetic material from two parents- a male and a female. They get half of the genetic material from each parent. The sperm from the male contains half of the genetic material, and the egg from the female contains half of the genetic material. Because offspring inherit a combination of genetic material from both parents, they are not exactly like either parent. Animals and most plants reproduce **sexually**. Some Fungi and Protists can reproduce **sexually**. A Paramecium is an example of an organism that can produce sexually or asexually.



Organize This!

<p>Halophile</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. One cell2. No nucleus3. Consumes food4. Reproduces with one parent	<p>Thermophile</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. One cell2. No nucleus3. Consumes food4. Reproduces with one parent	<p>Cyanobacteria</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. One cell2. No nucleus3. Consumes food4. Reproduces with one parent
<p>Bacteria</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. One cell2. No nucleus3. Consumes food4. Reproduces with one parent	<p>Paramecium</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. One cell2. Nucleus is present3. Consumes food4. Reproduces with one or two parents	<p>Euglena</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. One cell2. Nucleus is present3. Consumes food or can make its own4. Reproduces with one parent
<p>Amoeba</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. One cell2. Nucleus is present3. Consumes food4. Reproduces with one parent	<p>Mushroom</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Consumes food4. Reproduces with one parent	<p>Mold</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Consumes food4. Reproduces with one parent or two parents

<p>Pine Tree</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Makes its own food4. Reproduces with two parents	<p>Bluebonnet</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Makes its own food4. Reproduces with two parents	<p>Cactus</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Makes its own food4. Reproduces with two parents
<p>Koala</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Consumes food4. Reproduces with two parents	<p>Turtle</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Consumes food4. Reproduces with two parents	<p>Skunk</p>  <p>Characteristics:</p> <ol style="list-style-type: none">1. More than one cell2. Nucleus is present3. Consumes food4. Reproduces with two parents

Classification of Living Things

Part 1

Classification is the process of grouping things based on similarities. Biologists use classification to organize living things into groups so that organisms are easier to study.

The scientific study of how living things are classified is called **taxonomy**. Living things that are classified together have similar characteristics. Taxonomy is helpful because scientists know a lot about an organism's structures and relationships to other organisms.

To help scientists classify organisms, they ask themselves these four questions:

1. How many cells does the organism have?
2. Is a nucleus present?
3. How does the organism obtain its energy?
4. How does the organism reproduce?

There are four main characteristics that scientists use to classify organisms: 1) number of cells – *unicellular or multicellular*; 2) presence of nucleus – *prokaryote or eukaryote*; 3) how energy is obtained – *autotroph or heterotroph*; 4) mode of reproduction – *sexual or asexual*.

Aristotle

The Greek philosopher Aristotle was the first person known to classify living things scientifically. He only classified things as plants or animals. This classification system lasted for about 2,000 years.

Carolus Linnaeus

The modern classification system was developed in the 1700s by a Swedish scientist named Carolus Linnaeus. He observed many organisms and placed them in groups based on their visible characteristics.

Today, there are eight levels of classification.

Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species

The Domain is the broadest category of classification, while the species is the most specific level. We will only be learning about the Domains and Kingdoms in Grade 6.

Classification of Living Things

Part 2

Domains

The broadest category of classification is the **Domain**. There are three Domains in which all organisms are classified.

Eukarya is the Domain that all **eukaryotes** (organisms with an organized nucleus) are classified under. Approximately 89% of all organisms are eukaryotes. In the Eukaryota Domain, there are about 12.4 million species. This Domain includes four Kingdoms: *Animals, Plants, Fungi, and Protista*.

The next two Domains classify all organisms that are prokaryotes (no organized nucleus).

Archaea is the Domain that all Archaeobacteria are classified under. Approximately 4% of all organisms are Archaea. It is believed that there are about 600,000 Archaea species. These include bacteria that live in extreme environments such as arctic temperatures, hot springs, and volcanic vents. The environment where these organisms live is a major characteristic that separates these bacteria from all other bacteria. This domain only includes one Kingdom: *Archaeobacteria*.

Eubacteria is the Domain that all other bacteria are classified under. Approximately 7% of all organisms are Eubacteria. There are estimated to be about 1 million types of bacteria of which only 4,000 have been identified. These include bacteria that are decomposers and non-harmful bacteria that help our bodies, as well as disease causing bacteria. This Domain only includes one Kingdom: *Bacteria*.

No Eubacteria or Archaea have an organized nucleus, so all are prokaryotes.

Kingdoms

The second broadest category of classification is the **Kingdom**. There are six Kingdoms in which all organisms are classified.

Animals Dogs, cats, fleas, and sea coral are examples of animals. They are multicellular eukaryotes that are heterotrophs (consumers). Most, but not all, animals can move from one place to another. Most reproduce sexually, but some may be asexual (sea anemones).

Plants are multicellular, eukaryotes. All are autotrophs (producers), but in a few rare cases, some are also heterotrophs (Venus flytrap); however, they do not get their energy from the

flies they trap. Some plants produce flowers, while others do not. Examples of plants are grass, trees, vegetable plants, and weeds. They can reproduce sexually or asexually.

Fungi include organisms such as mushrooms, molds, and yeast. They are eukaryotes. Many are multicellular, but some are unicellular. All are heterotrophs. Most feed on dead or decaying organisms. They are found almost everywhere on land, but some live in water. They can reproduce sexually or asexually.

Protista are eukaryotes. Some are unicellular, and some are multicellular. Many of these organisms are microscopic such as Amoeba, Paramecium, and Euglena. Some are autotrophs and others are heterotrophs. They can reproduce sexually or asexually.

Eubacteria are unicellular prokaryotes that can be helpful or harmful. Bacteria in yogurt or your digestive system can be helpful, while bacteria that cause diseases such as E. coli or Salmonella can be harmful. Some of these bacteria are decomposers which play an important and helpful role in our ecosystem. Some are autotrophs while others are heterotrophs. They reproduce asexually. They live in moderate environments.

Archaeobacteria are unicellular prokaryotes that live in extreme environments such as volcanic vents, arctic temperatures, and hot springs. Some examples are halophiles and thermophiles. They can be autotrophic or heterotrophic. They reproduce asexually.

Who Am I

<p>I make my own food. Who am I?</p>	<p>I cannot make my own food, so I must find food to eat. Who am I?</p>
<p>I am made of one cell. Who am I?</p>	<p>I am made of many cells. Who am I?</p>
<p>I do not need a mate for reproduction. My offspring only have one parent. Who am I?</p>	<p>I must have a mate to reproduce. My offspring have two parents. Who am I?</p>
<p>I am a cell with an organized nucleus. Who am I?</p>	<p>I am a cell that does not have an organized nucleus. Who am I?</p>

Autotroph	Heterotroph
Unicellular	Multicellular
Asexual	Sexual
Eukaryote	Prokaryote

Guess Who

Animalia	Plantae
Fungi	Protista
Archaeobacteria	Eubacteria

<p>I am made of many cells. My cells have an organized nucleus. I have two parents and eat food.</p> <p>Guess Who?</p>	<p>I am made of many cells. My cells have an organized nucleus.</p> <p>I mostly have two parents, but sometimes one. I make my own food.</p> <p>Guess Who?</p>
<p>My cells have an organized nucleus. I am usually made of many cells, but sometimes I can be single celled. I cannot make my own food, so I must eat. I can have one or two parents.</p> <p>Guess Who?</p>	<p>I can make my own food, but sometimes I also eat food. I can have one or two parents.</p> <p>My cells have an organized nucleus. I am usually made of only one cell, but sometimes I am made of many cells.</p> <p>Guess Who?</p>
<p>I am only made of one cell. My cell does not have an organized nucleus. I only have one parent.</p> <p>Sometimes I make my own food, but other times, I eat food. I like to live in volcano vents, salt water of deep oceans, or the freezing cold Arctic.</p> <p>Guess Who?</p>	<p>I can make my own food, but sometimes I eat food. I am single celled, and I only have one parent. My cell does not have an organized nucleus. Sometimes I cause diseases. Other times I am a decomposer.</p> <p>Guess Who?</p>

AUTOTROPH	AUTOTROPH
SEXUAL	SEXUAL
UNICELLULAR	UNICELLULAR
HETEROTROPH	HETEROTROPH
ASEXUAL	ASEXUAL
MULTICELLULAR	MULTICELLULAR
PROKARYOTE	PROKARYOTE
EUKARYOTE	EUKARYOTE

Taxonomy of Organisms

Organism	Example: <i><u>Rabbit</u></i>	<i><u>Yeast</u></i>	<i><u>Bacillus</u></i>	<i><u>Pecan Tree</u></i>	<i><u>Methanogen</u></i>	<i><u>Eagle</u></i>	<i><u>Foraminifera</u></i>
Nucleus	<i>Eukaryote</i>						
# of Cells	<i>Multi-cellular</i>						
Food	<i>Heterotroph</i>						
Reproduction	<i>Sexual</i>						
Extreme Environment	<i>No</i>						
Kingdom	<i>Animalia</i>						
Domain	<i>Eukarya</i>						

Taxonomy of Organisms **KEY**

Organism	Example: <u>Rabbit</u>	<u>Yeast</u>	<u>Bacillus</u>	<u>Pecan Tree</u>	<u>Methanogen</u>	<u>Eagle</u>	<u>Foraminifera</u>
Nucleus	<i>Eukaryote</i>	<i>Eukaryote</i>	<i>Prokaryote</i>	<i>Eukaryote</i>	<i>Prokaryote</i>	<i>Eukaryote</i>	<i>Eukaryote</i>
# of Cells	<i>Multicellular</i>	<i>Both</i>	<i>Multicellular</i>	<i>Multicellular</i>	<i>Both</i>	<i>Multicellular</i>	<i>Unicellular</i>
Food	<i>Heterotroph</i>	<i>Heterotroph</i>	<i>Heterotroph</i>	<i>Autotroph</i>	<i>Both</i>	<i>Heterotroph</i>	<i>Heterotroph</i>
Reproduction	<i>Sexual</i>	<i>Both</i>	<i>Asexual</i>	<i>Sexual</i>	<i>Asexual</i>	<i>Sexual</i>	<i>Both</i>
Extreme Environment	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
Kingdom	<i>Animalia</i>	<i>Fungi</i>	<i>Eubacteria</i>	<i>Plantae</i>	<i>Archae-bacteria</i>	<i>Anamalia</i>	<i>Protist</i>
Domain	<i>Eukarya</i>	<i>Eukarya</i>	<i>Eubacteria</i>	<i>Eukarya</i>	<i>Archaea</i>	<i>Eukarya</i>	<i>Eukarya</i>

Domains & Kingdoms

Domain	Domain	Domain			
Kingdom	Kingdom	Kingdom	Kingdom	Kingdom	Kingdom
Examples	Examples	Examples	Examples	Examples	Examples

1. Write the names of the three Domains in the appropriate box above.
2. Sort the cards into the three Domains based upon their characteristics.
3. Write the names of the six Kingdoms in the appropriate boxes above.
4. Further sort the cards into the six Kingdoms, based upon their characteristics.
5. Write the name of each example in the proper box above.
6. What characteristics allow you to properly classify organisms?

7. How can you differentiate between a member of the Plantae Kingdom and a member of the Eubacteria Kingdom?

8. Complete the Semantic Feature Map by placing an X in the box if it applies to the Kingdom.

Kingdom:	Archaeabacteria	Eubacteria	Protist	Fungi	Plantae	Animalia
Eukarya						
Multicellular						
Heterotroph						
Sexual Reproduction						

Domains & Kingdoms

Archaea	Eubacteria	Eukarya			
Archaeobacteria	Eubacteria	Protista	Fungi	Plantae	Animalia
Examples Halophile Thermophile	Examples Cyanobacteria Bacteria	Examples Paramecium Euglena Amoeba	Examples Mushrooms Mold	Examples Pine Tree Bluebonnet Cactus	Examples Koala Turtle Skunk

- Write the names of the three Domains in the appropriate box above.
- Sort the cards into the three Domains based upon their characteristics.
- Write the names of the six Kingdoms in the appropriate boxes above.
- Further sort the cards into the six Kingdoms, based upon their characteristics.
- Write the name of each example in the proper box above.
- What characteristics allow you to properly classify organisms?

The presence/absence of a nucleus

The number of cells

How an organism obtains energy

The mode of reproduction is also used to classify organisms.

- How can you differentiate between a member of the Plantae Kingdom and a member of the Eubacteria Kingdom?

A plant is a multi-celled eukaryote. Plants are also autotrophic. The Eubacteria are unicellular prokaryotes.

Some bacteria are autotrophs, but most are heterotrophs.

- Complete the semantic feature map by placing an X in the box if it applies to the Kingdom.

Kingdom:	Archaeobacteria	Eubacteria	Protist	Fungi	Plantae	Animalia
Eukaryote			X	X	X	X
Multicellular			Both	X	X	X
Heterotroph	Both	Both	Both	X		X
Sexual Reproduction			Both	Both	X	X