

Focused Learning Lesson
Life Science
Grades 9-12
LS-H-C5

Overview:

Students will explore the justification for the development of the current taxonomic classification system of organisms. They will classify organisms into an established system according to the characteristics of the individual species.

Approximate Duration: 45 Minutes

Benchmark:

LS-H-C5 distinguishing among the kingdoms

GLE: 19. Compare the characteristics of the major kingdoms.

Benchmark:

SI-H-A2 designing and conducting scientific investigations

SI GLE: 2. Describe how investigations can be observation, description, literature survey, classification, or experimentation.

Objectives:

1. The student will compare characteristics of the major kingdoms.
2. The student will place representative organisms within their proper kingdoms.

Teacher Preparation:

1. The teacher should prepare the species cards according to class needs. Full size for whole class lesson, or reduced for individual work.
2. The teacher should display the species cards at the front of the class.

Materials/Equipment:

- Species cards
- Tape, pins or magnets to display and arrange cards

Lesson Procedures:

Set or Opener:

Tell the students, “As a class, we are going to imagine that we are preparing to open up a shoe store. I would like each of you to remove your left shoe and place it at the front of the class.” Have the students each remove their left shoe and place before the group. “These are the styles that we have available for sale. Your task is to group them so that they can be displayed in those groups and we can better serve our customers.” Students should now divide the shoes based on characteristics seen in the individual shoes. Athletic shoes grouped together, and then separated again by sport, or by gender, etc.

Body of the Lesson:

1. Cut out and display the representative species cards in random order where students can view them. They can be pinned to a bulletin board, attached by magnets to a magnetic surface, or taped to a blank wall. See Attachment 2.

2. Have the students separate the cards according to presence or absence of a nucleus. Remind students that prokaryotes are single-celled organisms that do not have a membrane bound nucleus. All organisms that do have a membrane bound nucleus and membrane bound organelles are eukaryotic.
3. Have the students separate the cards illustrating prokaryotic organisms into two separate groups by explaining that the make-up of the cell wall and cell membrane of some of the bacteria are similar to the eukaryotic groups, and the other bacteria do not share this similarity. Have them separate those that can live in an unusual habitat from others. With these three divisions, we represent the three domains: Bacteria, Archaea, and Eukarya.
4. Explain that the domains of bacteria and archaea each contain only one kingdom: domain bacteria consists of the kingdom Eubacteria, meaning “true bacteria,” and the domain archaea consists of the kingdom Archaeobacteria, which means “ancient bacteria.” Archeobacteria often live in extreme habitats that do not contain oxygen. Explain that kingdom Monera was split and this sixth kingdom was formed in the 1970’s, because these organisms are so different from the other bacterial organisms.
5. Have the students separate the cards of eukaryotic organisms into those that have cell walls and those that do not. Explain that this simple division between plant and animal cells was the original classification guidelines. As the scientists learned more about microscopic organisms, they discovered that there were no clear-cut divisions for these tiny, but complex organisms.
6. Depending on where the students place the Euglena, ask one of the following questions. If they placed it with the animals, remind them that it photosynthesizes. If they placed it with the plants, then explain that it has no cell wall, and can move and even consume food. As they grasp the idea, explain that the scientists had the same dilemma.
7. Now have them divide the eukaryotic organisms one into unicellular and multi-cellular organization.
8. Divide the multi-cellular into groups by the presence or absence of a cell wall.
9. Divide the group with cell walls into heterotrophs and autotrophs.
10. The species should now reflect the eukaryotic kingdoms: Protista, Fungi, Plantae, and Animalia.
11. Have students complete a chart of the current taxonomic system.

Closure:

Check for understanding by passing out additional species cards, and having them place the cards in the appropriate kingdom.

Attachments:

- Attachment 1: Teacher Background
- Attachment 2: Basic Species Cards
- Attachment 3: Additional Species Cards
- Attachment 4: Taxonomic Chart Key
- Attachment 5: Taxonomic Chart

Assessment:

Teacher observation of the card sort activity can be used for formative assessment. Student completed taxonomic charts can be used for either formative or summative assessment.

Reference Links and Technology Connections: N/A

Attachment 1

Teacher Background

Domain bacteria consists of the kingdom Eubacteria, meaning “True Bacteria,” and domain archaea consists of the kingdom Archaeobacteria, which means “Ancient Bacteria.” Archeobacteria often live in extreme habitats that do not contain oxygen. Explain that kingdom Monera was split, and this sixth kingdom was formed in the 1970’s because these organisms are so different from the other bacterial organisms.

Domain Eukarya is divided into four kingdoms.

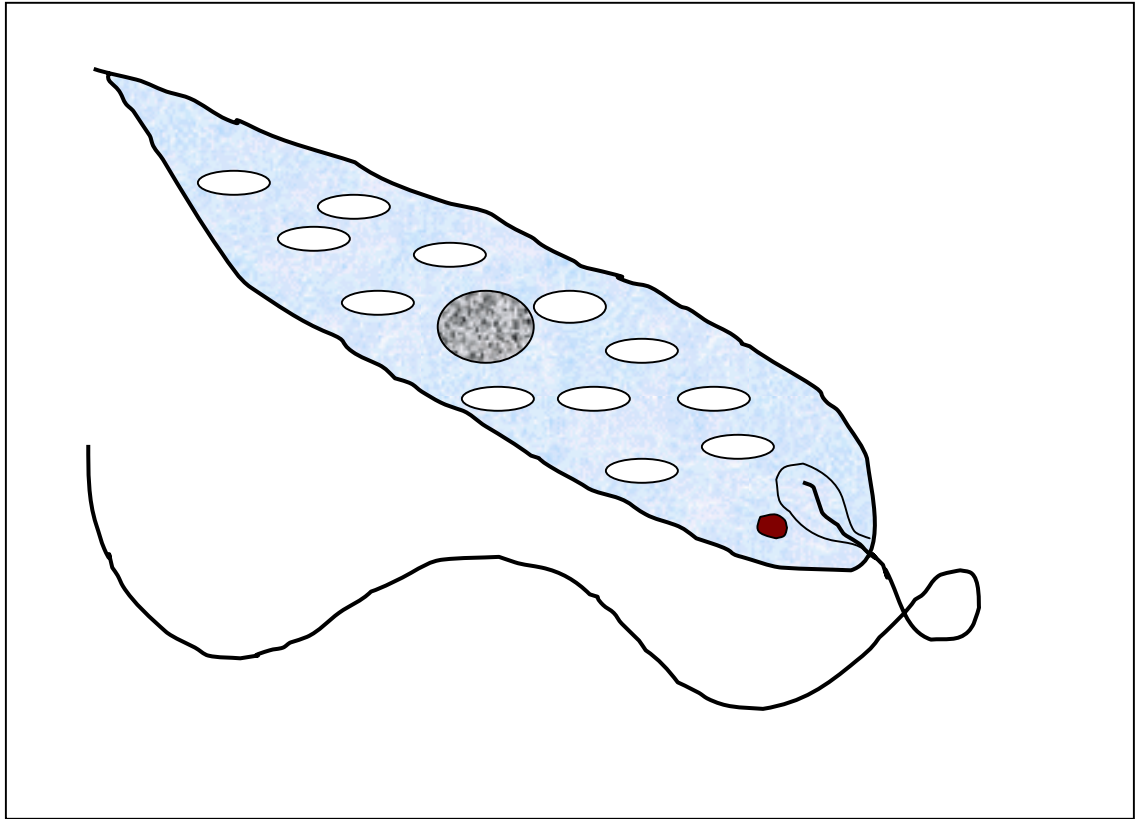
Kingdom Protista is the most diverse, and contains the organisms that were the hardest for scientists to classify. They are primarily organisms that did not qualify as Animal, Plant, or Fungi. Members of this kingdom are unicellular and multi-cellular, autotrophic and heterotrophic, and sexual and asexual. Most are unicellular. Some have cell walls, but some do not.

Kingdom Fungi are heterotrophic organisms that obtain their food by absorption. All but the yeasts are multi-cellular; the cells of these multi-cellular organisms have incomplete divisions between their cells called septae. Fungi cell walls are structurally different from plants because instead of cellulose, fungi cell walls are made of chitin. This kingdom reproduces both sexually and asexually.

Kingdom Plantae consists of organisms that are multi-cellular, autotrophic, and reproduce sexually by alternation of generations. Their cells are organized into tissues and organs, and chlorophylls a and b are found in plastids.

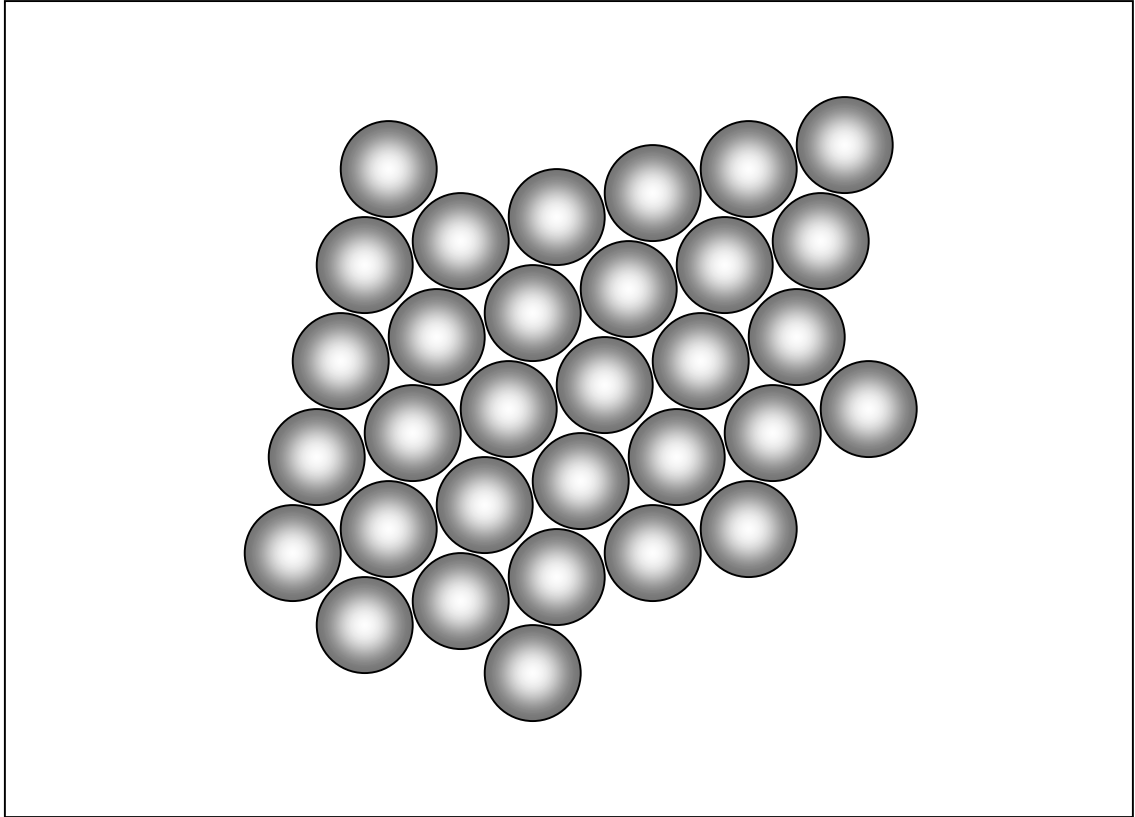
Kingdom Animalia is comprised of multi-cellular, heterotrophic organisms that obtain nutrition by ingestion, and reproduce sexually. Many animals have complex organs and organ systems, including highly evolved learning capabilities.

**Attachment 2
Basic Species Cards**



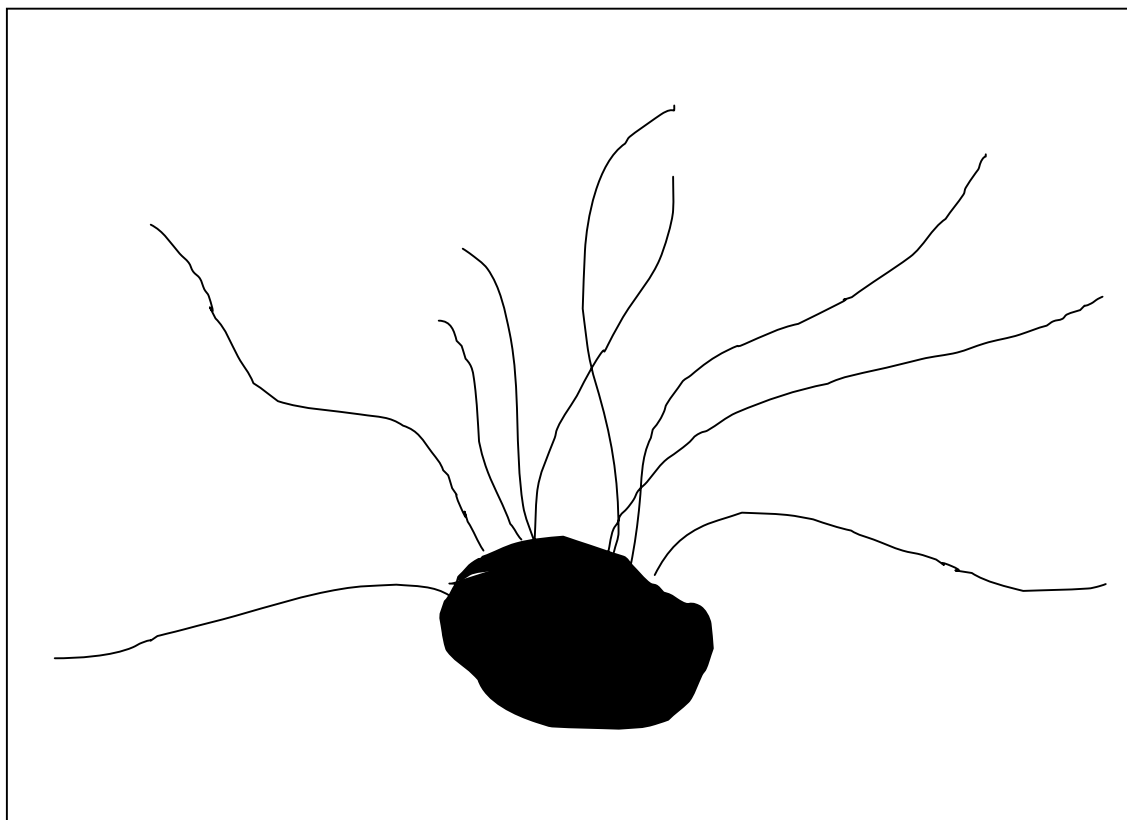
Scientific Name	<i>Euglena rubra</i>
Common Name	Euglena
Type of cell	Eukaryotic
Unicellular or multicellular	Unicellular
Type of nutrition	Autotrophic
Cell Wall	No cell wall
Mobile or immobile	Mobile
Method of reproduction	Asexual, by fission

Attachment 2 continued



Scientific Name	<i>Staphylococcus aureus</i>
Common Name	Staph
Type of cell	Prokaryotic
Unicellular or multicellular	Unicellular
Type of nutrition	Heterotrophic
Cell Wall	Cell wall
Mobile or immobile	Immobile
Method of reproduction	Asexual, by fission

Attachment 2 continued



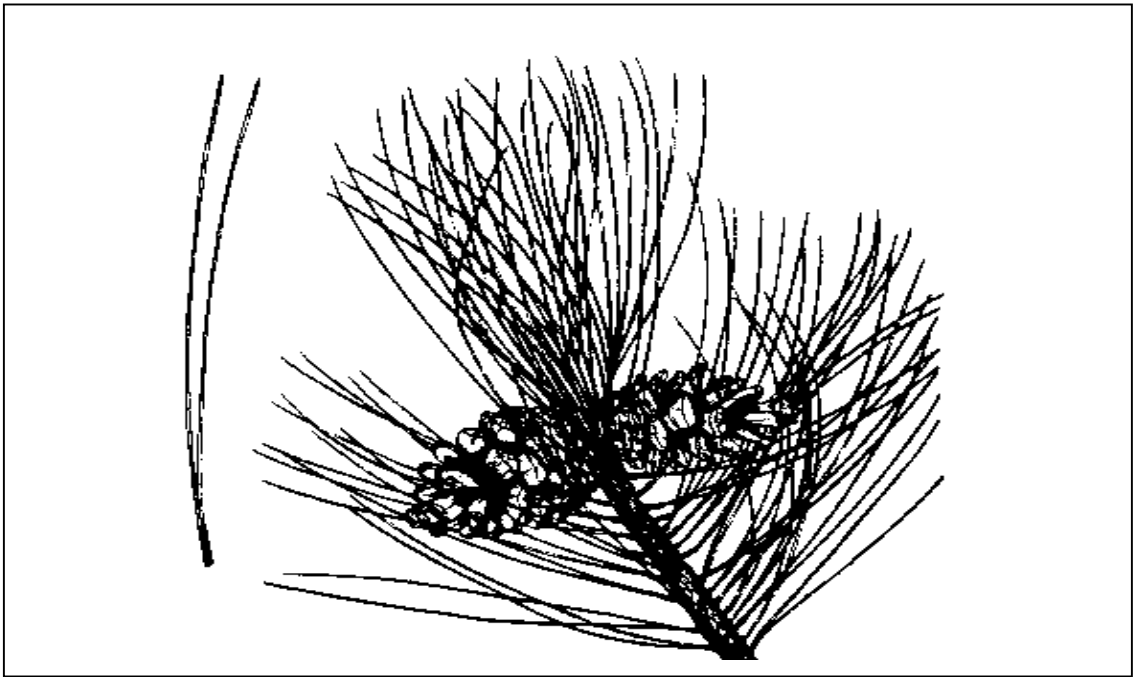
Scientific Name	<i>Pyrococcus furiosus</i>
Common Name	Thermophile
Type of cell	Prokaryotic
Unicellular or multicellular	Unicellular
Type of nutrition	Heterotrophic
Cell Wall	Cell wall
Mobile or immobile	Immobile
Method of reproduction	Asexual, by fission

Attachment 2 continued

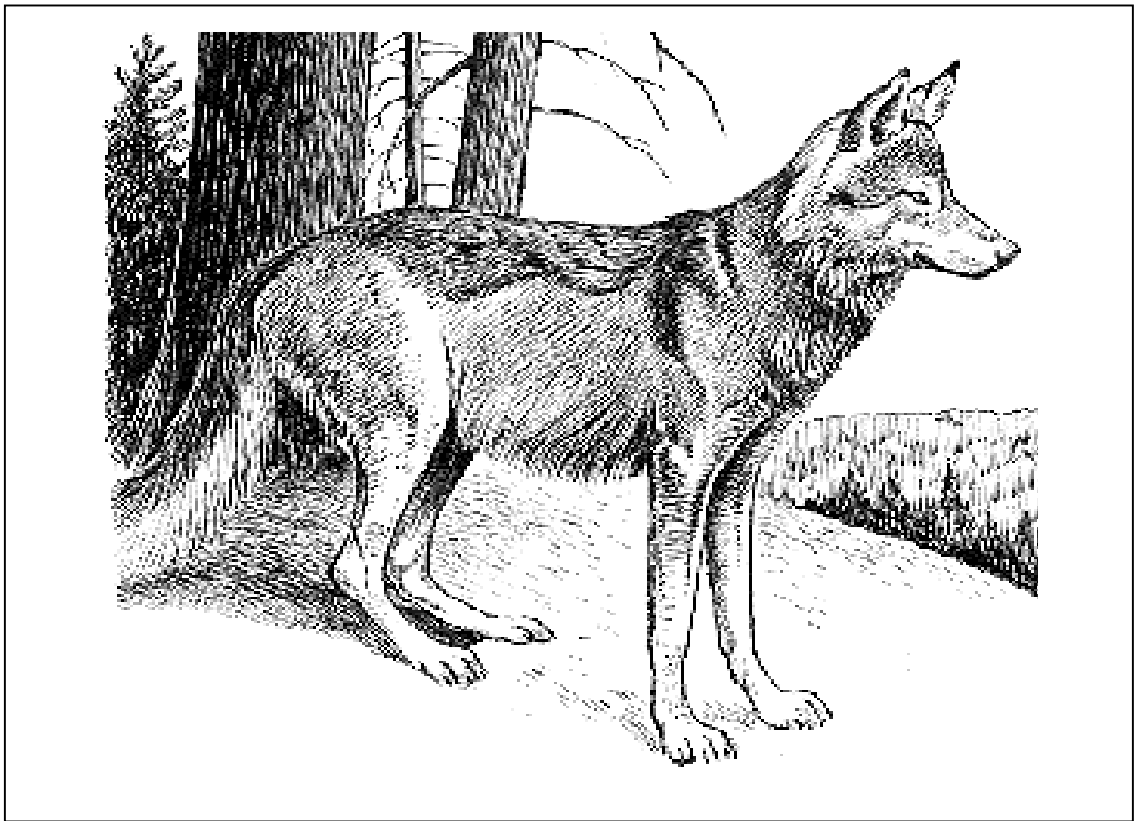


Scientific Name	<i>Mycorrhizae sp.</i>
Common Name	Root fungi
Type of cell	Eukaryotic
Unicellular or multicellular	Multicellular
Type of nutrition	Heterotrophic
Cell Wall	Cell wall made of chitin
Mobile or immobile	Immobile
Method of reproduction	Asexual and sexual

Attachment 2 continued

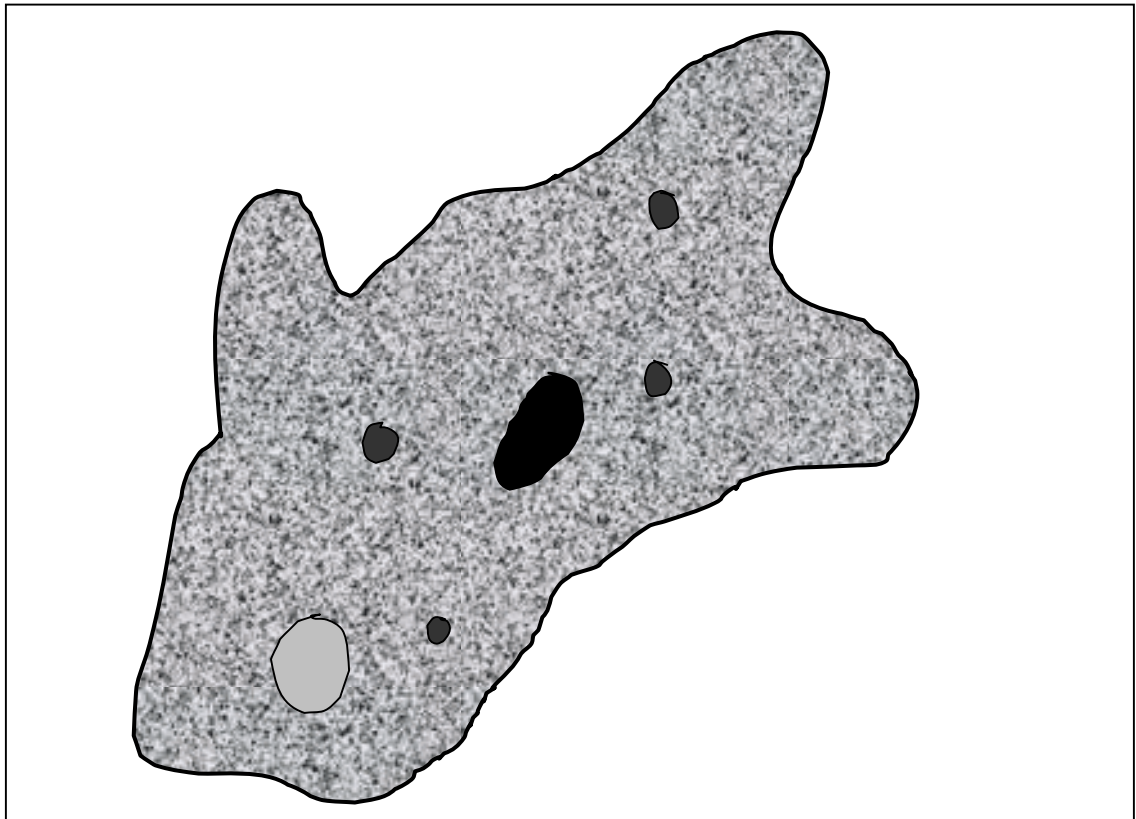


Scientific Name	<i>Pinus resinosa</i>
Common Name	Red Pine
Type of cell	Eukaryotic
Unicellular or multicellular	Multicellular
Type of nutrition	Autotrophic
Cell Wall	Cell wall made of cellulose
Mobile or immobile	Immobile
Method of reproduction	Sexual



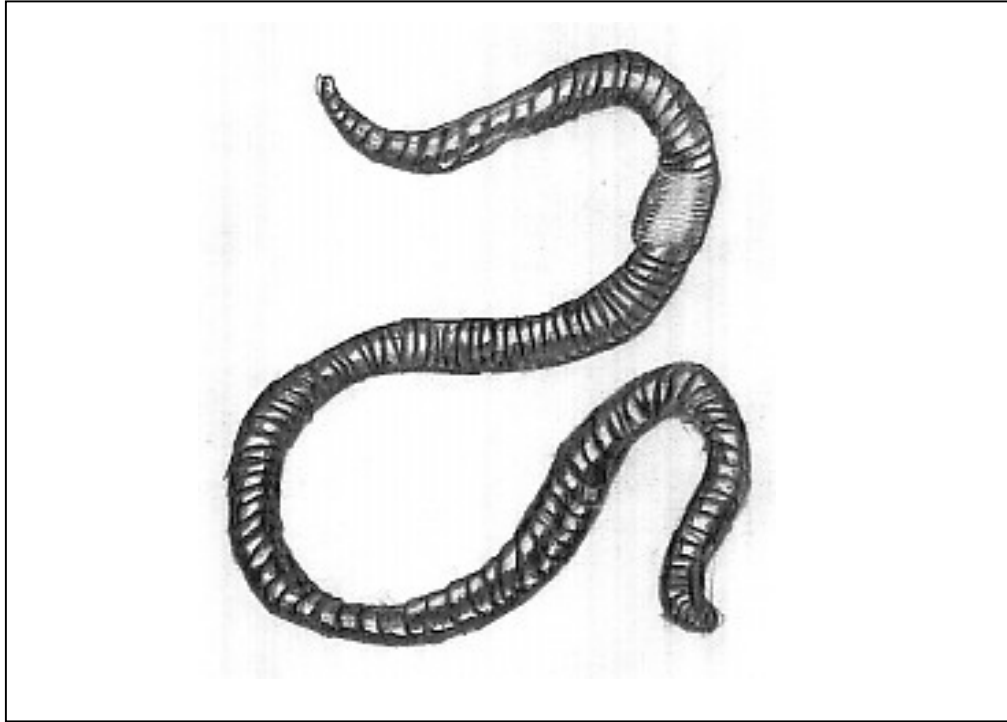
A. Scientific Name	<i>Canis lupus</i>
Common Name	Wolf
Type of cell	Eukaryotic
Unicellular or multicellular	Multicellular
Type of nutrition	Heterotrophic
Cell Wall	Absent
Mobile or immobile	Mobile
Method of reproduction	Sexual

Attachment 3
Additional Species Cards



Scientific Name	<i>Amoeba proteus</i>
Common Name	Amoeba
Type of cell	Eukaryotic
Unicellular or multicellular	Unicellular
Type of nutrition	Heterotrophic, by engulfing
Cell Wall	No cell wall
Mobile or immobile	Mobile
Method of reproduction	Asexual, by fission

Attachment 3 continued



Scientific Name	<i>Lumbricus terrestris</i>
Common Name	Earthworm
Type of cell	Eukaryotic
Unicellular or multicellular	Multicellular
Type of nutrition	Heterotrophic
Cell Wall	No cell wall
Mobile or immobile	Mobile
Method of reproduction	Sexual

Attachment 4: Taxonomic Chart Key

Domain	Archaea	Bacteria	Eukarya			
Kingdom	Archaeobacteria	Eubacteria	Protista	Fungi	Plantae	Animalia
Characteristics						
Type of cells	<i>prokaryotic</i>	<i>prokaryotic</i>	<i>eukaryotic</i>	<i>eukaryotic</i>	<i>eukaryotic</i>	<i>eukaryotic</i>
Unicellular or Multicellular	<i>unicellular</i>	<i>unicellular</i>	<i>unicellular</i>	<i>multicellular</i>	<i>multicellular</i>	<i>multicellular</i>
Type of Nutrition	<i>heterotrophic & autotrophic</i>	<i>heterotrophic</i>	<i>heterotrophic & autotrophic</i>	<i>heterotrophic</i>	<i>autotrophic</i>	<i>heterotrophic</i>
Have cell walls	<i>yes</i>	<i>yes</i>	<i>some yes, some no</i>	<i>yes</i>	<i>yes</i>	<i>no</i>
Mobile or Immobile	<i>immobile</i>	<i>immobile</i>	<i>mobile and immobile</i>	<i>immobile</i>	<i>immobile</i>	<i>mobile</i>
Method of Reproduction	<i>asexual</i>	<i>asexual</i>	<i>asexual</i>	<i>sexual and asexual</i>	<i>sexual</i>	<i>sexual</i>
Examples	<i>Bacteria that grow in hostile environments, includes aerobic and anaerobic forms</i>	<i>Disease causing bacteria, and others that are photosynthetic and chemosynthetic</i>	<i>Include amoeba, paramecium, and euglena, plus the simple algae</i>	<i>Mushrooms, molds, and mildew, and some disease sources such as ringworm and athlete's foot</i>	<i>Multicellular algae, and other plants such as pines, oaks, and grasses</i>	<i>Invertebrates such as sponges, worms, insects, and vertebrates such as reptiles and mammals</i>

Attachment 5: Student Taxonomic Chart

Domain	Archaea	Bacteria	Eukarya			
Kingdom	Archaeobacteria	Eubacteria	Protista	Fungi	Plantae	Animalia
Characteristics						
Type of cells						
Unicellular or Multicellular						
Type of Nutrition						
Have cell walls						
Mobile or Immobile						
Method of Reproduction						
Examples						