Science Unit Plan

Table of Contents

Rational

(a) Overall goals of the unit

The theme for this science unit is **classification** (excluding the animal kingdom which will be covered in the next unit). Students will examine how living things are organized into different kingdoms and become familiar with the general characteristics of each. Additionally, students will distinguish between non-living viruses (once thought to be living) and living organisms. The overall goals of the unit are for students to be able to:

- Understand the history, methods for, and purposes of classification. Students should recognize that classification systems continuously change as new information emerges.
- Explain current classification systems and the concept of binomial nomenclature.
- Use and create a dichotomous key.
- Summarize the distinguishing characteristics of viruses, protists, fungi, and plants as well as generally explain their importance to humans.
- Explain why viruses do not fit into any of the kingdoms and are considered non-living.
- Explain how technology, science, and society are often intertwined.

(b) Science content and processes as related to the Virginia SOLs and NSES

The following Virginia Standards of Learning will be addressed throughout this unit:

BIO. 1. The student will plan and conduct investigations which meet the following criteria:

a. Observations of living things are recorded in the lab and in the field;
b. Hypotheses are formulated based on observations and information from the scientific literature;
h. Chemicals and equipment are used in a safe manner;
i. Appropriate technology (computers, graphing calculators, and Probeware) is used for gathering and analyzing data and communicating results.
m. A scientific viewpoint is constructed and defended (the nature of science).

BIO. 2. The student will investigate and understand the history of biological concepts. Key concepts include the following:

e. The collaborative efforts of scientists, past and present.

BIO. 4. The student will investigate and understand relationships between cell structure and function. Key concepts include the following:

b. Exploring the diversity and variation of eukaryotes

BIO. 5. The student will investigate and understand life functions of archaebacteria, monerans (eubacteria), protists, fungi, plants, and animals (including humans). Key concepts include the following:

a. How their structures and functions vary between and within the kingdoms;
b. Comparison of their metabolic activities;
c. Analyses of their responses to the environment;

d. Maintenance of homeostasis;
e. Human health issues, human anatomy, body systems, and life functions;
f. How viruses compare with organisms.

BIO. 7. The student will investigate and understand bases for modern classification systems. Key concepts include the following:
a. Structural similarities in organisms;
e. Systems of classification that are adaptable to new scientific discoveries.

The following National Science Education Standards will be addressed throughout this unit:

Content Standard A. As a result of activities in grades 9-12, all students should develop:
- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard C. As a result of activities in grades 9-12, all students should develop understanding of:
- Interdependence of organisms
- Matter, energy, and organization of living systems
- Behavior of organisms

Content Standard E. As a result of activities in grades 9-12, all students should develop:
- Understandings about science and technology

Content Standard F. As a result of activities in grades 9-12, all students should develop understanding of:
- Personal and community health
- Natural resources
- Science and technology in local, national, and global challenges

Content Standard G. As a result of activities in grades 9-12, all students should develop an understanding of:
- Science as a human endeavor
- Nature of scientific knowledge
- Historical perspectives

(c) Unifying science concepts as addressed by NSES

The following National Science Education Standards' unifying science concepts will be addressed throughout this unit:

1. Systems, order, and organization.
2. Form and function.

(d) Description of learners, learning environment, community needs and resources

This science unit plan will be implemented in three high school college-bound (CB) biology classes at Hidden Valley High School in Roanoke, VA. A large majority of the students are in tenth grade. There is an equal mix of male and female students and all classes are very low in diversity. Only student out of about sixty total students has an Individual Education Plan (IEP), which requires additional time and note-taking outlines.

The surrounding community is largely affluent and white. The school was built in 2002 for a total cost of $22.2 million dollars. All science rooms include fully equipped labs, Smart boards, projectors, scanners, printers, and laptop docking stations. Additionally, all students and teachers are issued school laptops with wireless capabilities. Students regularly refer to blackboard for course assignments and grades. Additionally, in my cooperating teacher's class, students take most assessments online. I have emphasized the use of technology in this unit plan in order to take full advantage of available resources as well as to stay consistent with the school's priorities.

The school is surrounded by numerous colleges and universities (Roanoke College, Virginia Tech, Hollins University, Radford University, Virginia Western Community College, etc). According to the 2004-2005 school year profile, approximately 98% of students complete high school and more than 85% pursue some form of post secondary education.

(d) Pedagogical approach to teaching and learning, including classroom management considerations

There are certain factors that cultivate an effective learning environment. First, learning should be relevant, hands-on, and enjoyable. This allows students to become more engaged and prompts longer-term retention of information. Second, students should play an integral part in their individual learning process and should be encouraged to explore concepts both individually and cooperatively. Third, available technology should be integrated into the classroom on a frequent basis. Fourth, students should be provided with graphic organizers and note scaffolding in order to increase content comprehension. Fifth, students that are engaged are less likely to entertain themselves in other, less desirable, ways. Thus, discipline decreases as participation in learning increases. Sixth, it is important for the educator to consistently check for student comprehension. This should be done through formal and informal assessments. Lastly, learning should focus on both lower and higher level thinking skills and assessments should reflect this.

In this unit, I have provided for numerous hands-on and fun activities. I have also provided opportunities for students to recognize the relevance of living organisms to their own lives. There are lesson activities that give students greater freedom over their learning as well as opportunities to work independently and cooperatively. This unit plan also incorporates technology on a regular basis because students are accustomed to its frequent usage and are easily engaged by it. Additionally, I have provided specific graphic organizers and note-taking outlines so as to aid in student comprehension of this frequently difficult unit. There will be two formal online assessments, lab and activity sheet evaluations, and continuous informal assessments by asking students questions and walking around the room during activities. This

unit focuses on the general concepts of classification and avoids memorizing minutia. Instead, it is important for students to recognize and appreciate species diversity. Lastly, throughout the planning period, I concentrated on implementing teaching and learning strategies that I felt would be appropriate and successful for these particular students in this particular classroom.

Hidden Valley High School does not have an enormous amount of disciplinary issues. Those that do occur, however, include misuse of technology, tardies, and student socializing. Therefore, I will frequently circulate the room especially during technology days to ensure that students are on task. Students are already familiarized with the procedures for being tardy, thus making that less of an issue for me. Instead, my efforts will be focused on decreasing student socializing. This can be done by setting clear expectations and consequences, walking around the room during lessons, and creating lessons that are engaging for students. Students particularly enjoy using the technology. The classroom is already organized and set up in a way that is easy for student navigation and provides access to all instructional areas (visually and physically).

(f) Sequence of lessons in the unit

The science unit will cover the following topics, in order: (1) Overview of classification and dichotomous keys, (2) Viruses, (2) Protists, (3) Fungi, and (4) Plants. See the Table of Contents for specific lessons.

(g) Issue related to science-technology-society

The lesson on viruses will serve as the issue related to science-technology-society. Students will explore how viruses affect humans as well as how technology has assisted in our addressing this issue. Students will also explore how technology has added to our scientific understanding of viruses.

(h) Connections to history of development of science

The lesson on the history of classification and development of modern classification systems will serve as the unit's connection to the history and development of science.

CONCEPT MAP

Classification

I. History of Classification

II. Modern Classification Systems

A. Use/create Dichotomous Keys

III. Viruses

A. Transmission of Disease Lab

B. Disease Spread Gizmo

C. PowerPoint Notes

IV. Protists

A. Virtual Pond Dip

B. PowerPoint Notes

C. Hay Infusion

V. Fungi

A. The Fungus Among Us Online Tutorial

VI. Plants

A. Live specimens

B. PowerPoint Notes

VII. Final Assessment

An Introduction to Classification

Purpose / Rationale:

This lesson serves to expose students to the history of classification systems and the scientific processes that led to modern classification methods. This lesson also emphasizes why classification and using binomial nomenclature are necessary. Lastly, methods used to classify organisms are discussed.

VA SOLs:

BIO. 2. The student will investigate and understand the history of biological concepts. Key concepts include the following:
e. The collaborative efforts of scientists, past and present.

BIO. 7. The student will investigate and understand bases for modern classification systems. Key concepts include the following:
a. Structural similarities in organisms;
e. Systems of classification that are adaptable to new scientific discoveries.

Materials and Resources:

PowerPoint
Activity sheet
Internet / Laptops

Class Management and Safety Issues:

Students should follow the Acceptable Use Policy for using school computers and Internet.

Procedures:

Engage (10 minutes)

1. Show three slides that include photos of various things, living and non-living, and ask students how they would classify those things. Each slide includes four photos and serves as a separate classification activity. For example, one slide includes a human, dolphin, shark, and fish and students must decide how to classify each. Have students write down their responses on the provided notes handout.

Explore (10 minutes)

2. Various students will share the methods they used to classify the different groups of photos. The teacher and other students can then critique the methods used until a general consensus can be reached about reasonable classification systems. Through this, students can participate in the progression of ideas and experience how scientists work together to

develop classification systems. They can also identify the issues that arise while developing classification methods. Additionally, they can experience how scientific beliefs can change as new information emerges (for example, if students are told that DNA sequencing shows that humans and dolphins have more in common than dolphins and sharks).

Explain (15 minutes)

3. A PowerPoint presentation will cover the history of classification, current classification systems and methods used in order to classify, why classification is importance, the basics of binomial nomenclature, and a brief introduction to dichotomous keys. Students will be provided with a "skeleton" of the PowerPoint in which to take notes on.

Elaborate (10 minutes)

4. Students will review learned concepts by answering follow-up questions from the day's lesson included on the classification notes handout.

Evaluate

5. The classification notes handout will be collected and checked for note and answer completion. The following rubric will be used for grading:

Section	**# Questions**	**Points Each**	**Total Points Possible**
Notes	36	0.5	18
Follow-up Questions	4	1	4
	1	3	3
			25

Name _____ Period _____

Classification Notes

- How would ***YOU*** classify these things?

  Slide 1: _____

  Why? _____

  Slide 2: _____

  Why? _____

  Slide 3: _____

  Why? _____

- Early classification systems focused on impacts to humans. For example:
  - _____ vs. _____
  - _____ vs. _____
  - _____ vs. _____
- Aristotle (4th century B.C.) classified organisms based on:
  - _____ (land, air, water)
  - _____ (tall, medium, short)
  - This was used until the 1600's.
  - Problems : (1) _____

    (2) _____
- Renaissance / Age of Exploration in Europe, scientists used *really long* Latin names
- Carolus Linnaeus – Father of Modern Taxonomy
  - Taxa based upon _____ similarities
  - 2 kingdoms, _____ and _____

- Ranking system = _____ to _____
- _____ _____ = 2-naming system
- Latin names = *Genus species* or Genus species

- Current classification systems: _____ kingdoms
  - _____, _____ or _____, _____,

    _____, _____, _____, _____.
  - Acronym:
- Why use binomial nomenclature to classify? (1) _____ (2) _____
  - Based upon: Physical structure, biochemistry, metabolism
- Advances in _____ _____ influence classification of organisms.

---------- Follow-Up Questions ----------

1. How would you correctly write the Harbor Seal's Latin name using binomial nomenclature?

   Kingdom – Animalia, **Phylum** – Chordata, **Class** – Mammalia, **Order** – Carnivora, **Family** – Phocidae, **Genus** - Phoca, **Species** - vitulina

   _____ _____

2. Which animal is most closely related to the Oak weevil, *Curculio rectus*?

a.) Mullein Weevil (*Gymnetron tetrum*) b.) Hazelnut Weevil (*Curculio neocorylus*)

c.) Pine Reproductive Weevil (*Cylindrocopturus eatoni*) d.) Boll Weevil (*Anthonomus grandis*)

3. Go to http://anthro.palomar.edu/animal/table_humans.htm to find out how humans are classified from Kingdom to Species.

   _____, _____, _____, _____,

   _____, _____, _____

4. Which classification is ***most*** specific to humans? _____

   Which classification is ***least*** specific to humans? _____

An Introduction to Dichotomous Keys

Purpose / Rationale:

This lesson serves to familiarize students with the basics of a dichotomous key. This includes understanding how a dichotomous key is organized as well as how it can be useful. This lesson also serves as a "hypothetical" real-world application of shark classification and allows students to hypothesize and then defend their scientific viewpoints.

VA SOLs:

BIO. 1. The student will plan and conduct investigations which meet the following criteria:
- b. Hypotheses are formulated based on observations and information from the scientific literature.
- m. A scientific viewpoint is constructed and defended (the nature of science).

BIO. 4. The student will investigate and understand relationships between cell structure and function. Key concepts include the following:
- b. Exploring the diversity and variation of eukaryotes

BIO. 7. The student will investigate and understand bases for modern classification systems. Key concepts include the following:
- a. Structural similarities in organisms.

Materials and Resources:

"Using and Making A Biological Key" Activity sheet
PowerPoint including shark photos
Internet/Laptops

Class Management and Safety Issues:

Students should follow the Acceptable Use Policy for using school computers and Internet.

Procedures:

Engage (5 minutes)

1. Scenario: You are a shark biologist employed by the National Oceanic and Atmospheric Administration (NOAA). You have just been flown into the coastal city of Sao Luis in Brazil because locals have noticed an unidentified shark at their beaches. They are worried this shark species may be dangerous. You have been given the following assignment:
    a. Use the dichotomous key to become familiar with different shark species. You must correctly identify each one. After you have done this, you can now consider yourself an expert on sharks!

b. Looking at the photos provided to you by the locals (see PowerPoint), you are to identify the unknown shark species.
c. Using the Internet as a resource, decide what you would tell the locals about your finding. Report your findings to them in a short paragraph.

Explore (15-20 minutes)

2. Students will complete the "Using and Making a Biological Key" activity sheet by identifying the fourteen shark species using the attached dichotomous key.

Explain (5 minutes)

3. Throughout the activity, students will be collaborating to correctly identify the shark species. Once completed, students will answer corresponding questions on the activity sheet. Additionally, the teacher will ask a few wrap-up/review questions to make sure students understand the organization and usefulness of dichotomous keys.

Elaborate (15-20 minutes)

4. Now that students have become shark experts, they are to compare their shark outlines and/or dichotomous key to determine if they can properly identify the shark in the photos. Various views will be provided so as to aid in this process. They may or may not correctly identify the shark but the process of identifying is the important part (Answer = Rhinocodontidae, Whale shark). Once identified, they need to do a brief Internet search in order to figure out what they are going to tell the locals about the potential danger of the identified shark (1 paragraph).

Evaluate

5. Students will hand in the activity sheet w/ completed identifications and follow-up questions. Additionally, students will hand in the 1-paragraph conclusion given to the locals. The following rubrics will be used for grading:

Activity Sheet

Section	**# Questions**	**Points Each**	**Points Possible**
Sharks identification	14	1	14
Follow-up questions	2	2	4
Total			**18**

Shark ID Conclusion

Criteria	**Evidence**	**Scoring**
Shark identification	Shark spp name (hopefully Whale Shark)	1
Verdict	Not dangerous	1
Explanation	Planktonic feeder, No human attacks	3
Consistent w/ identification	Consistent w/ shark behavior/characteristics	2
	Total	**7**

Name Date

Using And Making A Biological Key

32

Classification is a way of separating a large group of closely related organisms into smaller subgroups. With a classification system, identification of an organism is easy. The scientific names of organisms are based on the classification systems of living organisms. To classify an organism, scientists often use a key. A key is a listing of specific characteristics, such as structure and behavior, in such a way that an organism can be identified.

In this investigation, you will

(a) use a key to identify fourteen shark families.
(b) study the method used in making statements of a key.
(c) construct your own key which will identify organisms appearing on page 128.

Materials

metric ruler

Procedure

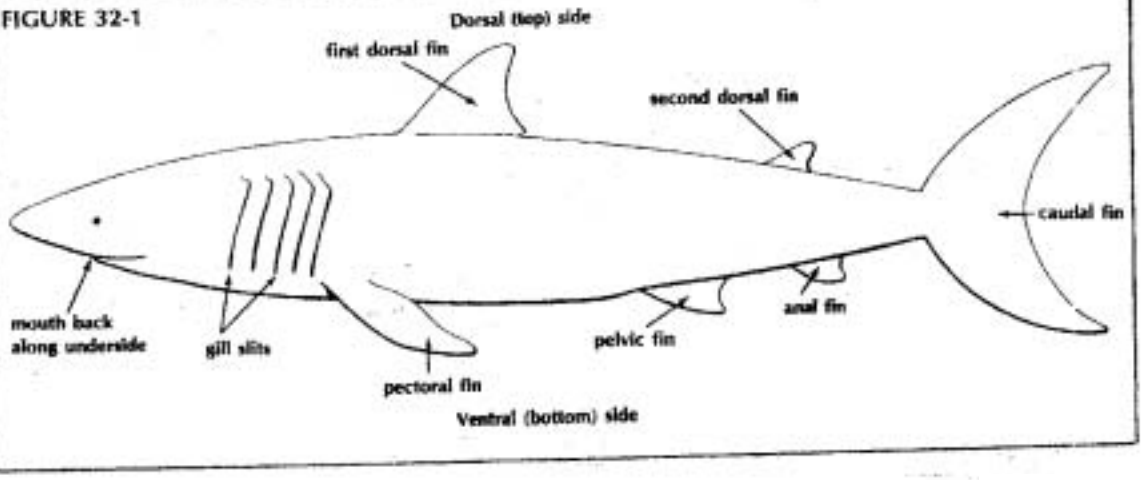
• Use Figure 32-1 as a guide to the shark parts used in the key on page 127.

• Read sentences 1A and 1B of the key. Then study Shark 1 in Figure 32-2 for the characteristics referred to in 1A and 1B. Follow the directions in these sentences and continue until a family name for Shark 1 is determined.

For example, to key a shark that has an anal fin and a body that is not kite shaped, follow the directions of 1A and go directly to statement 2. To key a shark that lacks an anal fin and has a kite shaped body, follow the directions of 1B and go to statement 10.

• Continue this process with each shark until all animals have been identified. Write the family name on the line below each animal.

FIGURE 32-1



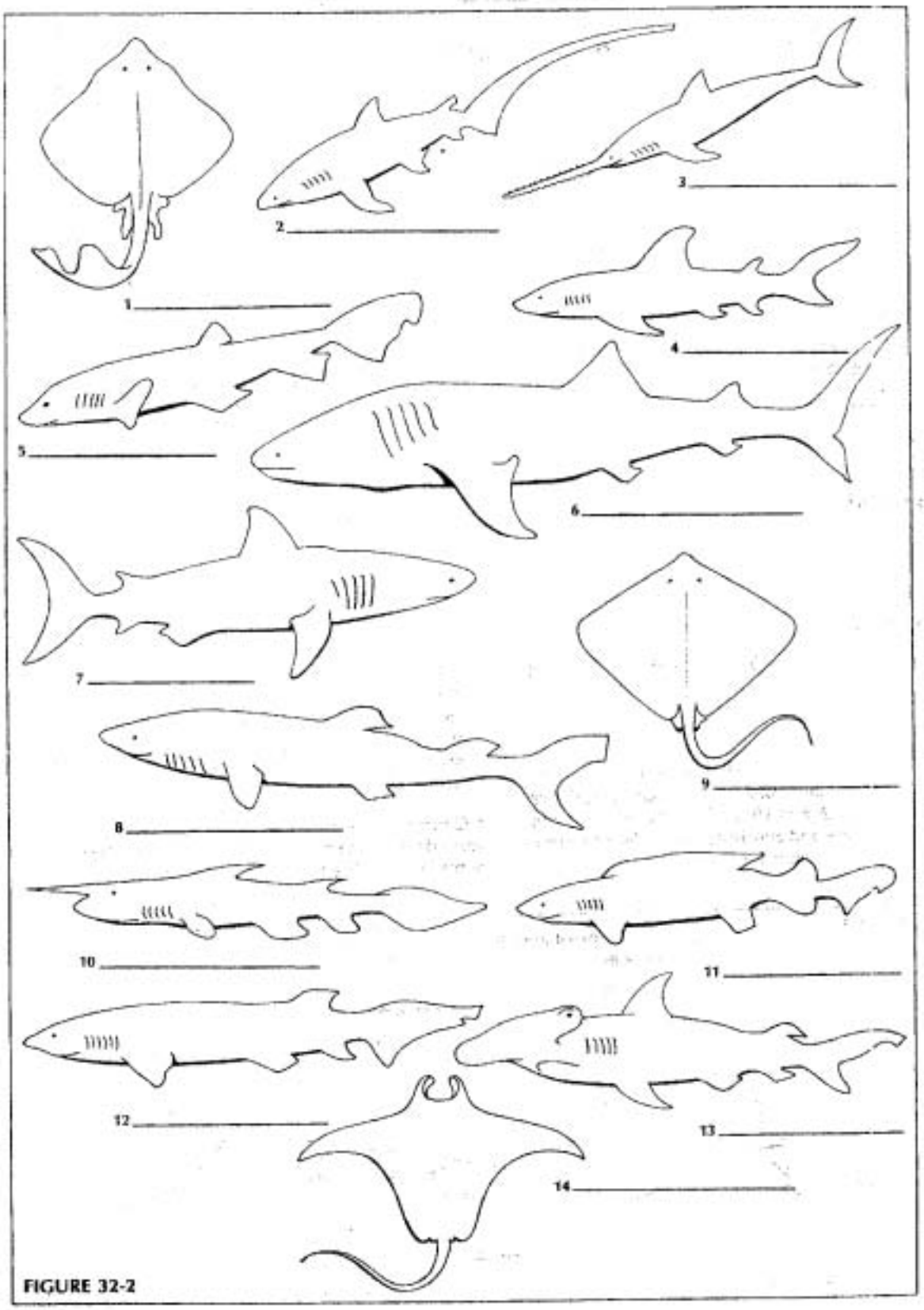


FIGURE 32-2

Name _____ Date _____

Key

1. A. Body kitelike in shape (if viewed from the top)..... Go to statement 12
   B. Body not kitelike in shape (if viewed from the top)..... Go to statement 2

2. A. Pelvic fin absent and nose sawlike..... Family Pristiophoridae
   B. Pelvic fin present..... Go to statement 3

3. A. Six gill slits present..... Family Hexanchidae
   B. Five gill slits present..... Go to statement 4

4. A. Only one dorsal fin..... Family Scyliorhinidae
   B. Two dorsal fins..... Go to statement 5

5. A. Mouth at front of head rather than back along underside of head..... Family Rhinocodontidae
   B. Mouth back along underside of head..... Go to statement 6

6. A. Head expanded on side with eyes at end of expansion..... Family Sphyrnidae
   B. Head not expanded..... Go to statement 7

7. A. Top half of caudal fin exactly same size and shape as bottom half..... Family Isuridae
   B. Top half of caudal fin different in size and shape than bottom half..... Go to statement 8

8. A. First dorsal fin very long, almost half total length of body..... Family Pseudotriakidae
   B. First dorsal fin regular length..... Go to statement 9

9. A. Caudal fin very long, almost as long as entire body..... Family Alopiidae
   B. Caudal fin regular length..... Go to statement 10

10. A. A long needlelike point on end of nose..... Family Scapanorhynchidae
    B. Nose without long point..... Go to statement 11

11. A. Anal fin absent..... Family Squalidae
    B. Anal fin present..... Family Carcharhinidae

12. A. Small dorsal fin present near tip of tail..... Family Rajidae
    B. No dorsal fin present near tip of tail..... Go to statement 13

13. A. Front of animal with two hornlike appendages..... Family Mobulidae
    B. No hornlike appendages..... Family Dasyatidae

Analysis

1. What is a biological key and how is it used? _____

_____

_____

2. List four different characteristics or traits that were used in the shark key. _____

_____

_____

Create Your Own Dichotomous Key

Purpose / Rationale:

This lesson serves to provide students with the opportunity to create their own dichotomous keys based upon their own classification methods. Additionally, students will then name their organisms based upon obvious physical features. This same method is often used in real-world naming procedures.

VA SOLs:

BIO. 7. The student will investigate and understand bases for modern classification systems. Key concepts include the following:
a. Structural similarities in organisms.

Materials and Resources:

Activity sheet
List of Latin names written on board
Blank dichotomous key handout
Colored pencils

Class Management and Safety Issues:

There are no specific class management and safety issues for this activity.

Procedures:

Engage (10 minutes)

1. "Remote Jungle Reveals New Species" (online article w/ photos) – Discussion of real-world application of today's activity (occurred recently in Papua New Guinea).

   Scenario: Congratulations!!! You are a scientist working in the Roanoke Valley who is part of a collaborative team that has just discovered numerous new species. You must now decide, within your collaborative group, how you are going to classify and name your organisms.

Explore (2 30-minute sessions)

2. Students will discuss the origins of scientific Latin names, such as *Xiphius gladius* (gladius = sword; swordfish), *Pinus virginia* (VA pine), and *Carcharodon carcharias* (carchar = jagged, don = tooth; Great White Shark). As a class, students will name one critter. Students will then get into groups and come up with scientific names that describe the other critters (3 per group). Students will then share and record all of the critters' names. Next, the class will begin developing a classification system for the critters. The

first two classification criteria will be outlined as a class. Students will then get into groups and complete the dichotomous key based on their own characteristics.

Explain (10 minutes)

3. The class will go over developed classification systems and the names given to the organisms. Students and the teacher will reflect upon issues that arose during this process. Students should also complete the provided activity sheet.

Elaborate (5 minutes)

4. Students will review the classification systems that they have developed and use a few keys to actually classify some of the critters.

Evaluate

- Activity sheet checked for completion (5 points)
- Latin names assigned and recorded on activity sheet (1 point each for 10 points total)
- Dichotomous key leading to each of the 10 critters (1 point each for 10 points total)

_____

25 points total

Name _____ Period _____

Create Your Own Dichotomous Key

Congratulations!!! You are part of a collaborative scientific team that has just discovered numerous new species in the Roanoke Valley. You must now decide, within your collaborative group, how you are going to classify and name your organisms. You will need to create your own dichotomous key.

I. Closely examine the new species. What characteristics do you think will be important in classifying these critters?

Number of eyes	_____
_____	_____
_____	_____
_____	_____
_____	_____

II. Use characteristics of your choice to create your own dichotomous key. *Remember: dichotomous keys always provide two options at each branch!* **Use the other handouts to do this.**

III. Replace the critters' number with a Latin name. Many Latin words (for body parts, etc.) have been posted for you. Write the Latin names below the picture of the critter.

IV. Throughout this exercise, what was the most difficult to do **and** why? _____

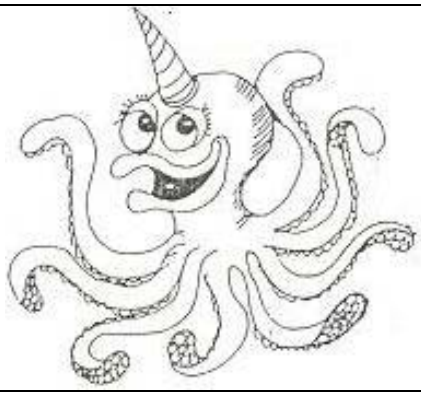
_____

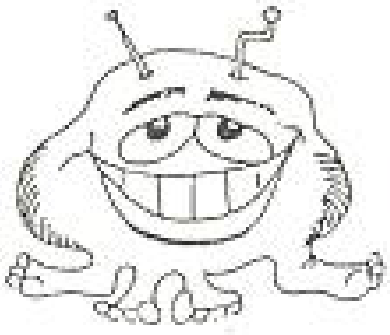
_____

V. Do you think this would also be difficult for real-world scientists? Why or why not? _____

_____

A. Construct a dichotomous key to classify these creatures.
B. Provide a scientific name for each of these creatures based on their characteristics.





1a		
1b		

2a		
2b		

3a		
3b		

4a		
4b		

5a		
5b		

6a		
6b		

7a		
7b		

8a		
8b		
9a		
9b		
10a		
10b		

Transmission of Disease

Adapted from: Melissa Portella (Science Ed. 2005)

2/27 – 2/29

Purpose / Rationale:

In this lesson, students will explore how science, technology, and society are integrated. Viruses have an enormous impact on human populations. Technology has allowed us to study, control, test for and/or treat these viruses. Students will first explore the basic characteristics of viruses, including why they are not considered living organisms. Students will do an online simulation of disease spread in which they can manipulate certain factors (method of transmission, number of people in a room, etc) and observe the corresponding effects on rate of transmission. Students will then do a lab simulation of the spread of disease within a population.

Viruses are included within the classification unit because they are included in VA SOL BIO.5 along with the living kingdoms. This classification unit not only focuses on classification itself but also on the characteristics of viruses, protists, fungi, and plants. It is necessary for students to understand that viruses have characteristics in common with living organisms but differ in important ways. It is also necessary that students understand the impacts that viruses have on human health issues. Additionally, viruses are given classification systems even though they are non-living.

VA SOLs:

BIO. 1. The student will plan and conduct investigations which meet the following criteria:

- e. Conclusions are formed based on recorded quantitative and qualitative data.
- h. Chemicals and equipment are used in a safe manner.
- i. Appropriate technology (computers, graphing calculators, and probe ware) is used for gathering and analyzing data and communicating results.

BIO. 5. The student will investigate and understand life functions of archaebacteria, monerans (eubacteria), protists, fungi, plants, and animals (including humans). Key concepts include the following:

- e. Human health issues;
- f. How viruses compare with organisms.

Materials and Resources:

"Outbreak" video (1995)
25 50-mL beakers
Distilled water
Bottle of Phenolthaline indicator
Eye dropper
.01 M solution Sodium Hydroxide
1 50-mL beaker
Transparency (empty data chart)

Biohazard sign
Doctor's office sign
Lab coat
Lab activity sheet
PowerPoint slides
Laptop computers
Activity sheets
Internet: www.explorelearning.com

Class Management and Safety Issues:

Students should follow all safety rules while in lab. This includes no horse-playing and running. This also includes following all directions explicitly and cleaning up at the end of lab (which includes proper disposal of chemicals).

Students should follow the Acceptable Use Policy for using school computers and Internet.

Procedure:

Engage (10 minutes)

1. Students will watch pre-selected clips from the movie "Outbreak" which will introduce viruses and their impacts on humans.

Explore (5 minutes)

2. Students will answer questions for each clip and briefly discuss responses as a class.

Explain (30 minutes)

3. Students will summarize the characteristics of a virus. This includes comparing a non-living virus to a living organism and outlining the three steps of viral infection. A notes outline will be provided for students to complete.

Elaborate (40 minutes each)

4. Students will complete the "Virus Life Cycle" and "Disease Spread" gizmos found on www.explorelearning.com. The first gizmo will review the life cycle of a virus in more detail. The second gizmo requires manipulating certain factors (method of transmission, number of people in a room, etc) and observing the corresponding effects on rate of transmission. Activity sheets will guide students through the process and will include additional assessment questions.

5. Students will then do a lab simulation of the spread of disease within a population.
    1. Each student will be provided with plastic Dixie cup filled with distilled water which represents their body fluids. One student will randomly be assigned cup that contains

drops of Sodium Hydroxide. This student represents the person that has become infected with the virus.

2. Students will then exchange body fluids with **three** other students by pouring one student's contents into the other student's beaker and then evenly distributing the body fluids between the two beakers. Students will record on their activity sheet each person's name that they exchange body fluids with.
3. After fluid exchange, students are notified that a viral disease is spreading through the population and that they should be tested for infection at once. Students will then report, one at a time, to the doctor's office. The doctor's office will be recognizable by an entrance sign and the "doctor" will be wearing a white lab coat. The teacher will place a few drops of Phenolthaline indicator into student beakers. A pink liquid coloration indicates a positive (+) result for the presence of the virus. If the liquid is clear, the student has tested negative (-).
4. Students who test negative must then put on a face mask and report to Quarantine.
5. All students will then place their names and results on the blank class data sheet .
6. Students will then attempt to identify the person originally infected.

Evaluate

6. Notes will be checked for completion (5 points). Students will complete the "Transmission of Disease," "Virus Life Cycle" and "Disease Spread Gizmo" activity sheets. The following rubrics will be used in grading:

Transmission of Disease Lab

Section	# Questions	Points Each	Points Total
Scenario	1	2	2
Before Testing	3*	4	12
Make a Guess!	1	2	2
Time to Get Tested!	1	5	5
Let's Track the Virus!	1	4	4
Summary	5	3	15
TOTAL			**40**

*3 points given for completing each round, 1 point for recording name

Virus Life Cycle

# Questions	Points Each	Points Total
17	1	17
1*	8	8
TOTAL		**25**

* Graph

Disease Spread Gizmo

# Questions	Points Each	Points Total
8	2	16
1*	4	4
TOTAL		**20**

* Final Question

Name _____ Period _____

Movie Clips: "Outbreak" (1995)

"The single biggest threat to man's continued dominance on the planet is the virus."
– Dr. Joshua Lederber, Nobel laureate

Clip 1: United States Army Medical Research Institute of Infectious Disease (USAMRIID)

1. This clip focuses on what section of the USAMRIID building?

_____

2. How is this section of the building organized?

_____

3. Give examples of how technology is integrated with science in this clip.

_____

Clip 2: Disease Spread

4. In this clip, how does the virus spread? _____

Clip 3: Viral Replication

5. What are the three steps of viral replication, outlined by the scientists?

(1)_____ (2) _____ (3) _____

6. How does one of the scientists (Kevin Spacey) classify the virus? _____

7. How does another scientist (Dustin Hoffman) describe the virus? _____

Clip 4: Sick Movie-Goer

8. How did the virus travel in this clip? _____

Clip 5: Viral Strains

9. What enabled the scientists to identify the two different viral strains? _____

Introduction to Viruses

Tobacco Mosaic Virus

What is a Virus?

- A particle that causes disease in organisms

- Nucleic acid core surrounded by
- Protein coat (called a capsid)
- Contain DNA/RNA
- Antigens allow virus to identify, attack, and enter target host

Living or Non-living?

- Lack nucleus and membrane-bound organelles
- Require no nutrients
- Totally dependent upon living organisms for survival, because they can only reproduce inside a host cell
- Not made of living cells, therefore it is non-living

Additional Info

- Each virus only infects a few specific hosts
- Viruses cannot be viewed without the help of an electron microscope

Viral Reproduction

- Insert genetic material into host cell
- Viral genetic material takes control of host cell and uses it to produce viruses
- Newly formed viruses released from host cell

Prevention and Treatment

- Antiviral drugs not as effective as antibiotics are with bacteria
- Not as numerous as antibiotics
- Vaccines most effective
  - substances that contain parts of antigens from an infectious organism. By stimulating an immune response (but not disease), they protect the body against subsequent infection by that organism
- Practice effective preventative measures

Name _____ Period _____

The Basics of a Virus

1. Virus = _____

2. Do *you* think viruses are living organisms? Explain. _____

_____

3. Characteristics of a virus:

   A. _____ _____ core surrounded by a _____ coat called a _____.

   B. Contain _____ or _____.

   C. Extensions, called _____, allow viruses to identify, attack, and enter its target host.

   D. Lack _____ and membrane-bound structures.

   E. Totally dependent upon living organisms for _____, because they can only _____ inside a host cell.

   F. Not made of _____ _____, therefore it is _____.

   G. Only _____ a few specific _____ species.

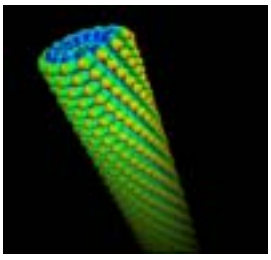
5. Viruses cannot be viewed without the help of an _____ _____.

   A. Steps in reproduction:

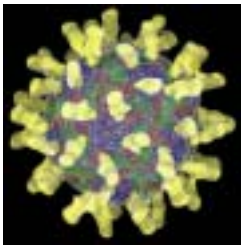
      1. Insert _____ _____ into host cell.

      2. Viral genetic material takes control of host cell and uses it to produce _____.

      3. Newly-formed viruses released from host cell.



www.scripps.edu/pub/olson-web/papers/sph/images



http://www.purdue.edu/UNS/paks/scipak.table.html

Name _____ Class _____ Date _____

Virus Life Cycle (Lytic Cycle)

Explore Learning

www.explorelearning.com – biology – taxonomy – microbiology/ Virus Life Cycle Gizmo

Imagine a sinister (and, luckily, fictional) military tank driving around in Michigan, where many American cars are made. Imagine that the tank finds a major auto factory and crashes through the wall into the plant, destroying itself. Imagine then that the crew (also sinister) gets out from the wrecked tank and re-trains the factory's workers to make other sinister tanks.

The plant produces more and more tanks until soon the factory can hold no more, and it literally bursts. Hundreds of tanks crash through the walls in every direction and rumble off across the countryside in search of more auto factories, where the process is repeated.

This story, while strange, is a remarkably accurate analogy of the life cycle of a virus. That tank represents a virus and the automotive factory is an infected cell. In the vocabulary of viruses, you can say that the virus causes the infected cell to burst, or **lyse**. A virus that causes this is called a ***lytic virus***.

Exploring Viruses

In this activity, you will examine the life cycle of a lytic virus.

1. In the Gizmo™, be sure that the **DESCRIPTION** pane is visible, and if the simulation is running, click Reset. Be sure that the first stage in the virus life cycle is selected. (You can use the right and left arrows to select the first stage of the life cycle, or simply click the first small virus image at the bottom of the **DESCRIPTION** pane.)
2. **Examine the diagram of this stage in the virus life cycle and read the information.**
   a. Why is this type of virus is called a bacteriophage?
   _____
   b. What are the basic parts of a virus? _____
   _____
3. **Examine the second and third stages of the life cycle and read the information.**
   a. What happens to the viral nucleic acid once it is inside the cell? _____
   b. What activity does the nucleic acid direct within the cell?
   _____ _____
   c. Nucleic acids provide the templates that are used in the production of proteins.
4. **Examine the fourth and fifth stages of the virus life cycle.**
   a. How do viruses kill the infected cell?
   _____
   b. This process is known as **lysis**.

5. **Click Play.** *Watch the simulation for about 120 to 130 (simulated) minutes. Then click Pause.*
   a. How does the number of viruses change as time passes?
   _____
   b. Also, would you say that the rate at which new viruses are formed speeds up, slows down, or stays about the same over time?
   _____

6. **Click Reset** (↺). Run the simulation again. This time you will be collecting data to illustrate your initial observation. Press the pause (⏸) button every 10 seconds to collect your data. Complete the data table below and prepare a graph *(Three lines/ three colors)* that shows you data.

Time (min)	# Healthy Cells	# Infected cells	# Dead cells
10			
20			
30			
40			
50			
60			
70			
80			
90			

Time (min)	# Healthy Cells	# Infected cells	# Dead cells
100			
110			
120			
130			
140			
150			
160			
170			

7. **Click Reset** (↺) and display the **TABLE** pane. This table will be updated every time the number of viruses, uninfected cells, or infected cells changes. Click Play (▶). After about 40 (simulated) minutes, click Pause(⏸).

   a. How many cells are there initially? _____
   b. At what time was the first cell infected? _____ How long after the first cell was infected were the newly created viruses released from the cell? _____
   c. Does this data match your data table and graph?_____

8. Click Play (▶) again. Let the simulation run until there are no healthy cells remaining.
   a. How long did it take for all 50 cells to lyse? _____
   b. Scroll up in the table. How much time did it take to reach the point at which there were 25 healthy cells remaining? _____
   c. Does this data match your data table and graph?_____
   d. Then how long did it take for those 25 cells to die? _____
   e. Does this data match your data table and graph?_____

   f. Based on your previous answers, would you say the rate of lysis increased or decreased as time went by? Explain your answer. _____

Make sure you look at the assessment questions below the Gizmo! You may see them on your quiz!

Name: Date:

Disease Spread Gizmo

Blackboard – CB biology – external links – Spread of Disease Gizmo

Pathogens are very small living things that can cause disease in plants, animals, and people. When a pathogen spreads widely, the results can be devastating. In the United States, an outbreak of influenza ("the flu") in 1918 killed approximately 675,000 Americans. Understanding how pathogens are transmitted helps us prevent diseases from spreading.

Foodborne and Airborne Transmission

Some diseases can spread through eating food or drinking water containing pathogens. For example, foodborne pathogens can cause the diarrhea associated with "food poisoning." Pathogens can also enter our bodies through the air we breathe. This kind of airborne transmission occurs when you catch a cold from a sneezing person or become sick from a pathogen in an air conditioning vent.

- Select the **Controls** tab. Place **20** people in the room by setting the **Number of people** slider to 20. Then, turn on **Foodborne** under **Allowed diseases**, and turn off **Airborne** and **Person-to-person**. Under **Probability of Transmission**, set the **Food-to-person** slider to High.

- Select the **Simulation** tab, and then click the **Play** button. Notice that when the simulation starts, all the people in the room are healthy. Each time a person goes to the buffet table at the top-left wall and eats or drinks something from it, however, he or she may ingest pathogens and become sick. While the simulation is running, inspect the table (on the **Table** tab) and the graph (on the **Graph** tab).

  a. *How does the speed of foodborne transmission of pathogens compare to the speed of person-to-person transmission?* _____

  b. *If a person in the simulation never eats or drinks anything from the buffet table, is it possible for them to become sick with the foodborne disease? Explain why or why not.* _____

- Select the **Controls** tab. Make sure there are still **20** people in the room. Then, turn on **Airborne** under **Allowed diseases**, and turn off **Foodborne** and **Person-to-person**. Under **Probability of Transmission**, set the **Airborne** slider to High.

- Select the **Simulation** tab, and then click the **Play** button. Notice that when the simulation starts, all the people in the room are healthy. Each time they breathe the air in the room, however, they have a chance of catching the airborne disease. While the simulation is running, inspect the table (on the **Table** tab) and the graph (on the **Graph** tab).

  c. *How does the speed of airborne transmission of pathogens compare to the speed of person-to-person transmission?* _____

  d. *If a person in the simulation never eats or drinks anything from the buffet table, is it possible for them to become ill with an airborne disease? Explain why or why not.* _____

  If the same disease could spread through both airborne and foodborne transmission, would it spread more quickly or more slowly than if it could only spread by one of these means? Think about your answer, and then check it by running another trial of the simulation with both **Airborne** and **Foodborne** turned on under **Allowed diseases** on the **Controls** tab. Explain how the simulation's results support your answer. _____

Name: Date:

Person-To-Person Transmission

You can also catch a disease through physical contact between healthy and infected people. For example, a person infected with one of these diseases might accidentally pass on his or her pathogens to healthy people by shaking their hands or patting them on the back. These are examples of person-to-person transmission.

- In the Gizmo™, select the **Controls** tab. Place **5** people in the room by setting the **Number of people** slider to 5. Then, turn on **Person-to-person** under **Allowed diseases**, and turn off **Airborne** and **Foodborne**. Under **Probability of Transmission**, set the **Person-to-person** slider to **High**.

- Select the **Simulation** tab. Notice that the simulation starts with one infected person and four healthy people. Click the **Play** button. The people will begin to walk randomly about the room. Each time a healthy person comes in contact with an infected person, the healthy person has a chance of becoming infected. Watch the simulation until all the people in the room are infected, then select the **Table** tab. The table shows when each person caught the disease.

  *e. How long did it take for all 5 people to become sick?*_____

- Click the **Reset** button and then the **Play** button to try the experiment again under the same conditions. Look at the table to see when all the people in the room became sick.

  f. How does this compare to what you found in the previous experiment? Explain why the times can be different. _____

- Select the **Controls** tab. Increase the **Number of people** in the room to **35** using the slider. Then, select the **Simulation** tab and start the simulation by clicking **Play**. Look at the table (on the **Table** tab) and the graph (on the **Graph** tab).

  g. How do your results with 35 people in the room compare to your results with 5 people in the room? _____

  h. Why do you think this is? _____

Name _____ Period _____

Lab Activity: Transmission of Disease

*Will **YOU** become infected?*

www.aegis.com www.fftc.agnet.org

You are watching the news and see a story about a virus that is spreading throughout the local community. The virus spreads through the exchange of bodily fluids. You become increasingly worried about your risk of infection and have decided to go to the doctor's office in order to get tested for the virus.

Virus: We must first decide what virus we would like to infect our community. Write down the virus chosen by the class: _____

Before Testing:

1. You need to obtain your body fluids. In order to do this, I will come around and give you one Dixie cup filled with distilled water. This will represent your bodily fluids. However, **one** of you will be given a cup that contains a few drops of Sodium Hydroxide. This represents the virus and so you will already be infected with the disease and have the potential to infect those people you swap bodily fluids with. **You will not know if you already have the disease or not!**
2. Next, you will need to swap bodily fluids with **three** people in your community.
   - Choose a partner
   - One of you needs to pour your liquid into the other person's cup.
   - Now your fluids have mixed.
   - Pour half of the liquid back into the empty cup. You should both now have an equal amount of bodily fluids.
   - Record your partner's name in the following data table.
   - You need to do this **THREE** times **ONLY**!

Trial #	Partner Name
1	
2	
3	

Make a Guess

4. How many people do you think will become infected by the end of the lab? *Remember, only **one** person will be infected with the virus in the beginning.* _____

Time to Get Tested

5. Now that you have swapped bodily fluids with others, you are at-risk for an infection. You have now decided to go to the doctor.

- One at a time, make a doctor's visit. I can be found in my white lab coat in the area labeled "Doctor Follin."
- I will place a few drops of Phenolthaline indicator into your cup. If pink, you tested positive (+) for the virus. **You must then put on a face mask and report to Quarantine**. If clear, you tested negative (-) for the virus. Write your test results below:

  Test results: _____

- Now, record your name and results on the class data sheet.

Let's Track the Virus

5. Looking at the class data, who was originally infected with the virus? _____

Summary Questions

6. In the end, how many people were infected with the virus? _____
7. What percentage of the population does this represent? _____
8. Why would it be important to find out where/who the virus came from? _____

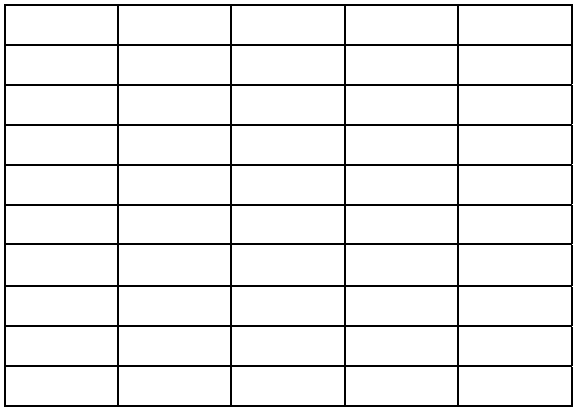
_____

9. What preventative measures could have been taken to avoid exposure to the virus? _____

   _____

   _____

10. Draw a bar chart that represents the percentage of people that were exposed/unexposed in the beginning and by the end of the lab (so you should have four bars total). **Label your axes.**



The World of Protists

Purpose:

This lesson will give students the opportunity to explore protists through an online virtual lab as well as a hay infusion lab. Students will identify common protists, gather general background information on each, and discover that there is much more to the world than meets the eye! Students will discuss the three major groups of protists as well as the importance of these tiny living organisms. Students will also gain experience in observing living organisms and using lab equipment.

VA SOLs:

BIO. 1. The student will plan and conduct investigations which meet the following criteria:
- a. Observations of living things are recorded in the lab and in the field.
- h. Chemicals and equipment are used in a safe manner.

BIO.4. The student will investigate and understand relationships between cell structure and function. Key concepts include the following:
- b. Exploring the diversity and variation of eukaryotes

BIO.5. The student will investigate and understand life functions of archaebacteria, monerans (eubacteria), protists, fungi, plants, and animals (including humans). Key concepts include the following:
- a. How their structures and functions vary between and within the kingdoms
- c. Analyses of their responses to the environment

Materials and Resources:

Laptop computers / Internet
http://www.microscopy-uk.org.uk/index.html?http://www.microscopy-uk.org.uk/ponddip/index.html (Virtual Pond Dip)
Activity sheet
PowerPoint
Protist note outline

Jar (mayo or jam, etc)
Hay
Pond or creek water
Petri dishes
Pipette
Antibacterial soap for clean-up
Few grains of yeast
Lab activity sheet

Classroom Management and Safety Issues:

Students should follow the Acceptable Use Policy for using school computers and Internet.

Students need to practice proper lab conduct while working with lab equipment and living organisms. Also, the hay infusion has a very high bacteria count. While most are not harmful to humans, there may be bacteria in the culture that could cause infection on contact. Students need to wash with soap and water if the culture gets on skin or rinse their eyes if any of the culture liquid contacts them. Wash any cuts that make contact with water and then sterilize with hydrogen peroxide or iodine.

Procedures:

Engage (25 minutes)

1. Students will be shown a jar of pond water and asked how much life they think exists in the jar. Students will then watch a "Bill Nye: The Science Guy" video regarding protists.

Explore (45 minutes)

2. Students will participate in an online virtual pond dip where they will begin to familiarize themselves with potential pond water microorganisms. Students will complete an activity sheet that outlines organism name, size, general notes about where to find it or an interesting fact, and a quick sketch. The virtual pond dip can be found at http://www.microscopy-uk.org.uk/index.html?http://www.microscopy-uk.org.uk/ponddip/index.html.

Explain (15 minutes)

3. Students will explore the basic characteristics and classification of protists through PowerPoint slides (both goals of the overall unit plan). This will include going over the four protists groups as well as protist importance. Various photos will also be shown. Notes in outline form will be provided.

Elaborate (90 minutes)

4. Students will complete the hay infusion lab, thus observing live organisms (specifically protists). They will also complete a corresponding lab sheet. Preparation for the lab includes collecting a pond/stream water sample into a jar, adding a few drops of skim milk and yeast (as a food source for microorganisms), adding hay, and allowing the solution to incubate at room temperature with partial sunlight exposure for a few days to a week. Additional oxygen will be provided to the solution at least once a day by using a pipette to bubble air into the water.

Evaluate

5. The virtual pond dip activity sheet will be graded based upon how many organisms students identify and record information for (1 point each for a total of 15 points).

6. The lab handout will be graded as follows:

At least 4 drawings of observed protists with name and mode of motility identified	12 points total (each specimen worth 3 points)
First 6 summary questions, 1 point each	6 points total
Last summary question	2 points total
	20 POINTS

.

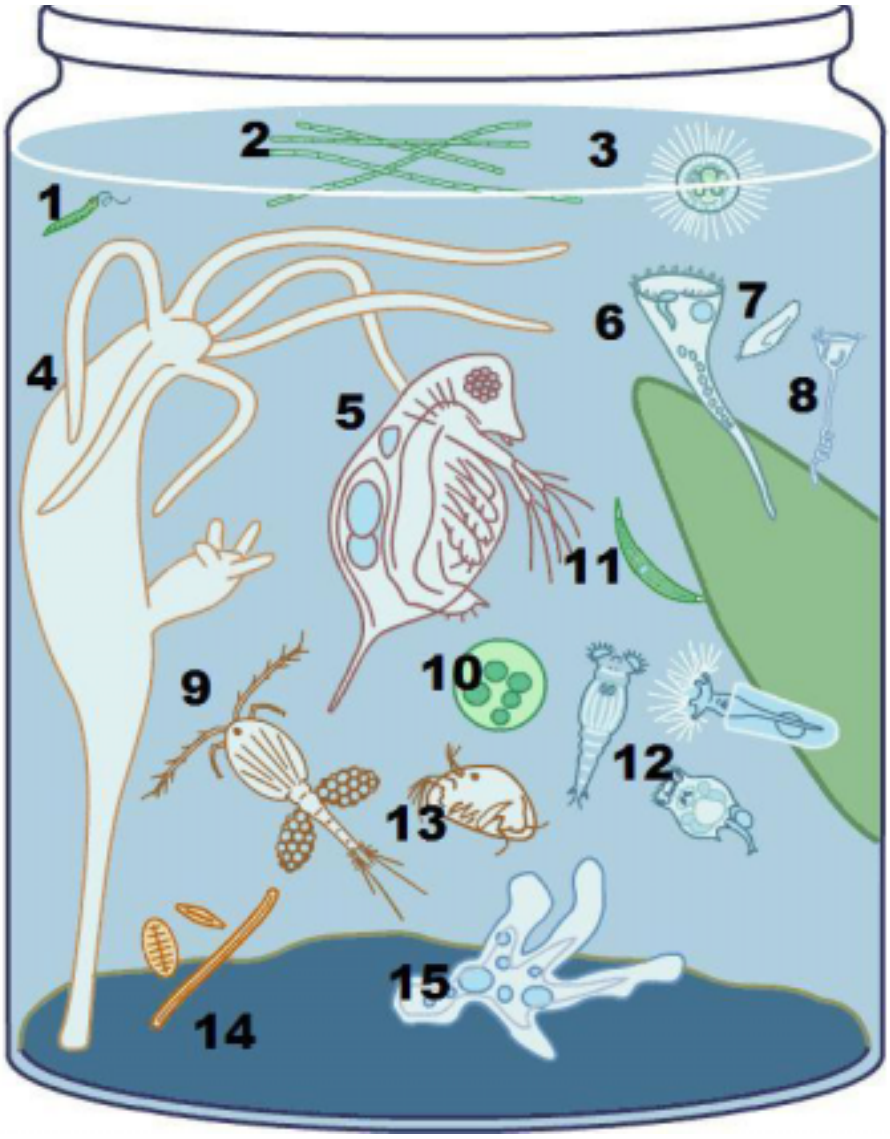
A Virtual Pond Dip

Take a dip in the jar to learn about some common types of smaller pond life.

The tiny organisms found in pond water are fascinating subjects to study under the microscope, and can captivate both beginners and experienced microscopists for a lifetime!

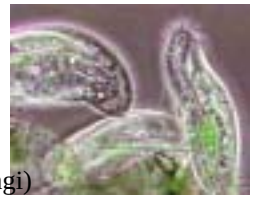
This virtual pond dip introduces some of the more common types and hopefully encourages an exploration of the incredible 'world within a world' of a real pond.

Click the mouse over each organism to display its factfile, which also gives links to more detailed articles.



	Name	Size	Notes/ Where to find them	Sketch
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

NOTES: The World of Protists



- Simplest _____
- Most are _____, some are _____
- Usually lumped together because of what they are NOT! (Not animals, plants, or fungi)
- Grouped by how they obtain _____, 3 groups:
  - _____ = animal-like _____
  - _____ = plant-like _____
  - _____ = fungus-like _____

- **Protozoans** (Animal-like)
  - _____ (some are even parasitic)
  - Groups based on how they _____:
    1. Sarcodinians – move with lobes of _____ that extend outward (ex. Amoeba)
    2. Zooflagellates – move by _____ (ex. Euglena)
    3. Ciliates – move by _____ (ex. Paramecium)
    4. Sporozoans - _____ - _____ protozoans (ex. Malaria)
  - Importance: 3rd most numerous organisms in_____, planktonic food source
  - Feed on _____, _____, diatoms, algae; help keep numbers in balance

- **Algae** (Plant-like)
  - _____
  - Grouped as _____ or _____:
    - Unicellular = diatoms, euglenoids, dinoflagellates
    - Multicellular = Red algae, red algae, brown algae
  - Importance: part of _____, habitat for _____ (kelp = sea otters)
- **Slime-molds** (Fungus-like)
  - Decomposers, saprophytic = _____
  - _____slime-molds, _____ slime-molds, and _____ molds

Name _____ Period _____

Hay Infusion Lab Handout

Today we're going to closely examine our pond water sample for the presence of protists, especially protozoa. These are interesting micro-organisms that are easy to study under the microscope due to their relatively large size. Most are motile through means of cilia, flagella, or pseudopodia.

Note: Wash your hands after you have completed the lab due to the pond water bacteria.

Procedure

5. Use a pipette to obtain a sample from the **top** of the pond water.
6. Place a drop of liquid specimen on a microscope slide.
7. Focus starting at 4x and magnify up to 10x.
8. Use the dichotomous key and diagrams provided to help identify organisms.
9. Note the means of motility (cilia, flagella, pseudopodia).
10. Sketch any organisms you identify.
11. Repeat all steps using a sample from the **bottom** of the pond water.

	Drawings from Pond water			
Top				
	Name / Motility	Name / Motility	Name / Motility	Name / Motility
Bottom				
	Name / Motility	Name / Motility	Name / Motility	Name / Motility

Summary Questions

1. Were you surprised with the amount of microorganisms you found in the pond water?

   Explain. _____

   _____

   _____

2. In our sample, what do the protists feed on? _____

3. List the protists you found that are protozoa. _____

   _____

4. What makes a protist more animal-like? _____

   _____

5. List the protists you found that are plant-like. _____

   _____

6. What makes a protist more plant-like? _____

   _____

7. Now that you know the importance of various protists, explain what you think would happen if they did not exist. _____

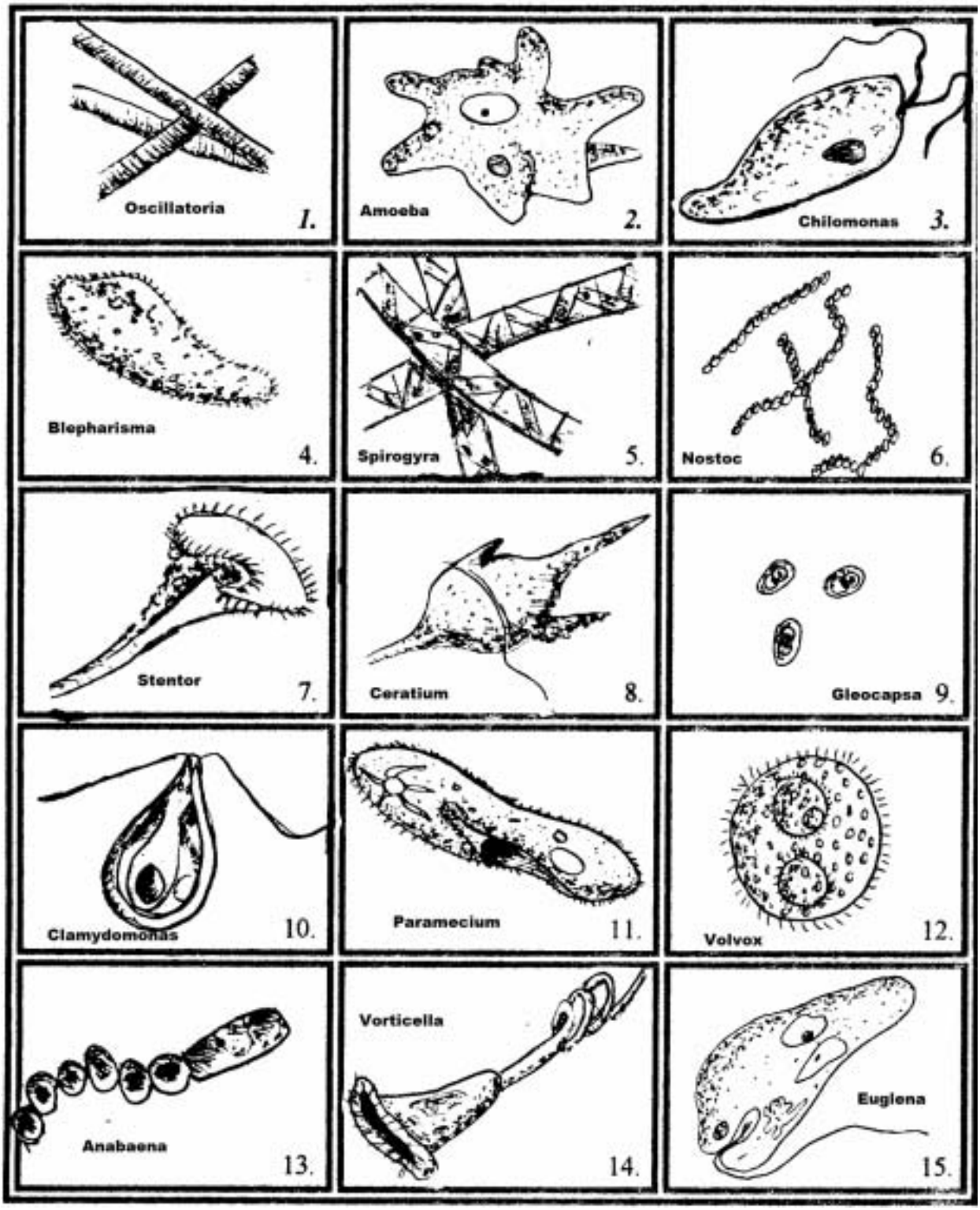
   _____

   _____

   _____

   _____

Dichotomous key for Protists		
1	Contains green pigment	2
	Does not contain green pigment	3
2	Lives in a colony	4
	Does not live in a colony	5
3	Has cilia or flagella	6
	Does not have cilia or flagella	Amoeba
4	Colony is long and filamentous	8
	Colony is spherical	Volvox
5	Has a flagellum	7
	Does not have a flagellum	Gleocapsa
6	Has cilia	9
	Has flagella	10
7	The flagellum is at one end	Euglena
	The flagellum wraps around it’s equator	Ceratium
8	Filament of cells is tube-like	11
	Filament of cells is like a string of beads	12
9	Cilia cover the entire outer surface	13
	Cilia surround only an opening at one end	14
10	Pear-shaped with a posterior nucleus	Chamydomonas
	Slipper shaped with a central nucleus	Chilomonas
11	Has spiraled strips of choloplasts	Spirogyra
	Does not have chloroplasts in spirals	Oscillatoria
12	All bead-like cells are the same size	Nostoc
	Some bead-like cells are longer than others	Anabaena
13	Cell has a star-shaped vacuole at one end	Paramecium
	Cell does not have a star-shaped vacuole	Blepharisma
14	Has a spiraled, stem-like structure	Vorticella
	Does not have a spiraled stem-like structure	Stentor


Oscillatoria
1.
Amoeba
2.
Chilomonas
3.
Blepharisma
4.
Spirogyra
5.
Nostoc
6.
Stentor
7.
Ceratium
8.
Gleocapsa
9.
Clamydomonas
10.
Paramecium
11.
Volvox
12.
Anabaena
13.
Vorticella
14.
Euglena
15.

The Fungus Among Us

Purpose:

This lesson will introduce students to the basic characteristics and roles of fungi, including their importance to humans. This will be done through an online website in which students will answer certain directed questions but then have the opportunity to explore the website on their own in a less-directed manner. This method will allow students to gain content knowledge without it being teacher-directed. Additionally, students are often naturally engaged by technology.

VA SOLs:

BIO. 4. The student will investigate and understand relationships between cell structure and function. Key concepts include the following:
b. Exploring the diversity and variation of eukaryotes

BIO. 5. The student will investigate and understand life functions of archaebacteria, monerans (eubacteria), protists, fungi, plants, and animals (including humans). Key concepts include the following:
a. How their structures and functions vary between and within kingdoms
c. Analyses of their responses to the environment

Materials and Resources:

PowerPoint
Laptops / Internet
Activity sheet
http://www.virtualmuseum.ca/~mushroom/English/index2.html
TLC "Medical Marvels" video clip

Classroom Management and Safety Issues:

Students should follow the Acceptable Use Policy for using school computers and Internet.

Procedures:

Engage (10 minutes)

1. Students will be shown a clip from the TLC documentary "Medical Marvels" in which one man's life is severely altered after a fungal infection.

Explore (10 minutes)

2. Students will examine various photos of fungi (examples from around the world), which demonstrate fungi diversity. They will then be asked what role they think fungi plays in humans' daily lives.

Explain (25 minutes)

3. Students will explore "The Fungus Among Us" website and complete an activity sheet. They will then share their answers to particular questions with the class. This should provide an opportunity for each student to make sure they have recorded accurate information on their own activity sheets.

Elaborate (5 minutes)

4. Students will continue to explore the fungus virtual museum, with the incentive of answering a final bonus question.

Evaluate

5. The activity sheet will be collected and checked for completion only (10 points) since, as a class, we will go over the activity sheet to make sure all students have recorded the correct information.

The Fungus Among Us

http://www.virtualmuseum.ca/~mushroom/English/index2.html

Life as we know it would not exist without fungi. They have an enormous impact on our every day lives. This online activity serves to familiarize you with the basic characteristics and roles of fungi, including their importance to humans.

Click on **It's a Fungusful World!**:

1. List 3 types of fungi: 1) _____ 2) _____ 3) _____

Click on **Fungus in our Lives**:

Roles of fungi:

1. Fungi is used to make _____, beers, wines, and blue cheeses.
2. Fungi are great _____, playing a major part in breaking down organic matter (decomposers).
3. Fungi supply plants with fresh _____.
4. Trees rely on networks of fungi working in partnership with their _____.
5. Fungi cause famine and _____ in plants, animals, and humans.

Click on **Fungal Science**:

6. Until the 1700s, biologists thought fungi were _____.
7. Only when the _____ was invented were scientists able to reveal important differences.
8. All fungi are masses of fine branching threads or tubes, called _____, spreading outwards in their quest for food.
9. Unlike a plant or animal, the body of a fungus is not divided into tissues or _____.
10. Unlike plants, fungi lack _____, the molecule used in photosynthesis.
11. Fungi utilize plant or other organic matter by releasing a variety of powerful _____ into their surroundings.
12. Fungi toughen their cell walls with _____, the material that also forms the exoskeletons of insects, crabs, and lobsters.

Plant Classification

Purpose:

This lesson serves to introduce students to the plant kingdom. Students will become familiar with plant classification as well as basic characteristics. An introductory lesson will be provided before assigning students a packet that they will complete at their own pace the following week. This packet will include an online tutorial, a fruit lab, a flower lab, and a final assessment. Students will then have an opportunity to extend their learning outdoors.

VA SOLs:

BIO. 4. The student will investigate and understand relationships between cell structure and function. Key concepts include the following:
b. Exploring the diversity and variation of eukaryotes

BIO. 5. The student will investigate and understand life functions of archaebacteria, monerans (eubacteria), protists, fungi, plants, and animals (including humans). Key concepts include the following:
a. How their structures and functions vary between and within the kingdoms
c. Analyses of their responses to the environment

BIO. 7. The student will investigate and understand bases for modern classification systems. Key concepts include the following:
a. Structural similarities in organisms
c. Systems of classification that are adaptable to new scientific discoveries

Materials and Resources:

Fruit samples
Flower samples
PowerPoint
Notes outline
Laptop/Internet
Online tutorial activity sheet

Classroom Management and Safety Issues:

Students are expected to follow the HVHS AUP while working online.

Procedures:

Engage (5 minutes)

1. Students will be prompted to share with the class how they think plants are classified. The teacher will take a quick assessment on student prior knowledge.

Explore (150 minutes/3 periods)

2. Students will be provided with a packet that they will complete throughout the week at their own pace. This packet includes various activities to familiarize students with the plant kingdom.

Explain (throughout the week)

3. Throughout the week, the teacher will check for student understanding.

Elaborate (50 minutes)

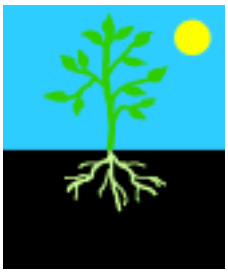
4. Students will explore plants outside of the classroom by taking a walk on the nature trail that surrounds the school. They will apply knowledge learned throughout the week.

Evaluate

5. Students' plant packets will be graded partly for accuracy and partly for completion (depending upon the particular question). All questions are worth 1 point each, for a total of 75 points.

NOTES: The Plant Kingdom

1. A plant is . . .



   a. Autotrophic = can make its own _____.

   b. Eukaryotic = true membrane-bound _____.

   c. Multicellular

2. The ancestor of plants

   a. Plants evolved from a _____.

   b. Plant moved from water to land about _____ million years ago.

3. The earliest plants: Adaptations for land

   a. Cuticle: _____.

   b. Short: did not need much _____; no roots, stems or leaves

   c. Alteration of _____: life cycle involve 2 phases (for sexual reproduction).

4. Modern Plants . . .

   a. All plants are either _____ or _____.

   b. Vascular tissue = specialized for long distance transport of _____ and _____ through a plant.

5. Nonvascular plants include mosses, liverworts, and hornworts; lack _____

6. Vascular plants include:

   A. Seedless plants: Club mosses, _____, whisk ferns, horsetails

   B. Seed plants:

      1) _____ (ginkgo, ephedra, cycads, conifers)

      2) _____ (flowering plants)

7. Plant Reproduction

A. The term gymnosperm means "_____."

1) This means that the _____ are NOT enclosed in any special tissue

B. In angiosperms (_____ plants), the seeds are enclosed in a special tissue called the _____. Not all fruits are sweet and large like apples and oranges.

8. Angiosperms

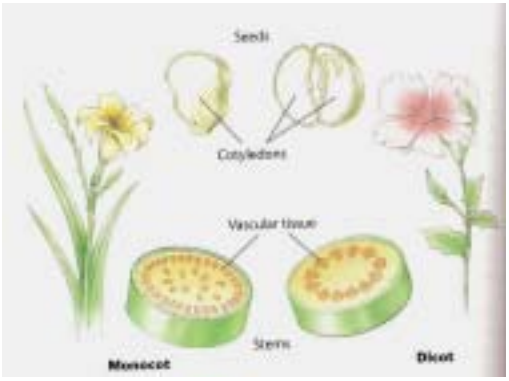
A. Monocots:

1) ___ cotyledon

2) Narrow _____, _____ veins

3) Flower parts in multiples of _____

4) _____ vascular bundle tissues



B. Dicots:

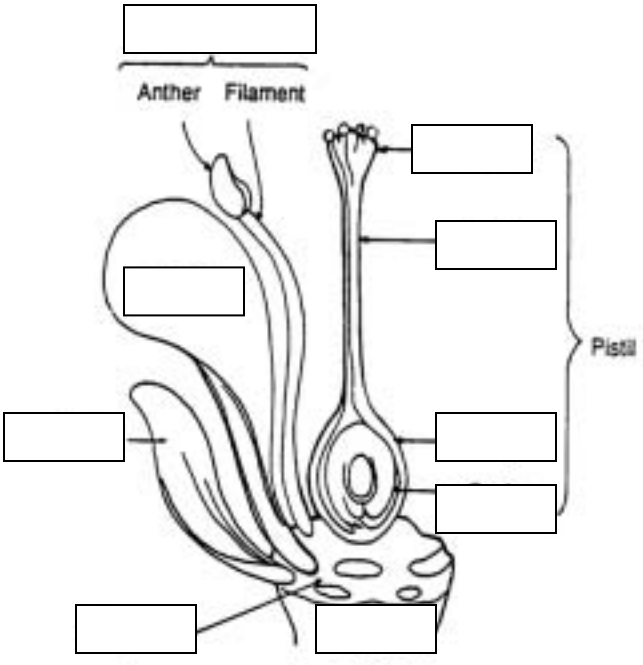
1) _____ cotyledons

2) Broad leaves, _____ veins

3) Flower parts in multiples of _____.

4) Vascular tissue in _____.

FLOWER PARTS



Natural Perspective: Plant Classification

1. Complete the table below:

Phylum	Tissue Structure	"Seed" Structure	Stature	Picture Copy/ paste a picture
Bryophyta ( )	_____ (*Bryophytes*)			
Psilophyta ( )	_____ (*Tracheophytes*)			
Lycopodophyta ( )				
Sphenophyta ( )				
Filicinophyta ( )				
Cycadophyta ( )				
Ginkophyta ( )				
Coniferophyta ( )				
Gnetophyta ( )				
Angiospermophypta ( )				
Dicotyledons ( )				
Monocotyledons ( )				

Please see the plant page for a discussion of the different classification methods

Mosses and Allies

2. List the two stages that mosses go through for reproduction
    a.
    b.

3. What is unique about the chloroplasts in hornworts?

Ferns and their Allies

4. Explain how the sporophyte and gametophyte stages differ between mosses and ferns:

5. What is a vascular system?

6. Discuss the type of habitat that ferns grow in.

Conifers and their Allies

7. Look at the picture. What do we commonly call the structure that contains conifer seeds?

8. List at least 6 common species names that are Conifers:
    a. _____
    b. _____
    c. _____
    d. _____
    e. _____
    f. _____

Flowering Dicot Plants/ Flowering Monocot Plants

9. List three characteristics of monocots and dicots and give examples of each:

	Monocots	Dicots
Characteristics		
Examples		

Name Date

Flower Anatomy

47

Flowers are more than ornamental parts of a plant. They are the reproductive structures of angiosperms, the flowering plants. Flowers are structures for sexual reproduction. Thus, angiosperms are widespread.

In this investigation, you will

(a) observe macroscopically and identify the reproductive structures of a plant.
(b) observe microscopically certain parts of flowers.
(c) label diagrams of the structures associated with plant reproduction.
(d) give the functions of flower parts.
(e) learn how monocot and dicot flowers differ.

Materials

tobacco flowers
razor blade (single-edge)
microscope
water
microscope slides—2
coverslips—2
hand lens (or binocular microscope)
dropper
sunflower (optional)
colored pencils—red, blue, green

Procedure

Part A. Macroscopic Examination

Flowers have many different sizes, shapes, and numbers of parts. You will study a tobacco flower because it has all the flower parts.

The outside of a tobacco flower has two parts. Sepals are green, leaflike parts at the base of the flower. Tobacco has five sepals. These parts are joined so it is difficult to see each sepal. Sepals protect the young flower.

Petals are the brightly colored parts of a flower. Tobacco has five petals. However, they are fused making counting difficult. Petals protect the flower parts inside. Their colors may also attract insects.

NOTE: If using preserved flowers, the colors of petals and sepals may have faded.

- Properly label Figure 47-1 using words *sepals* and *petals*.

- Remove the petals of your flower by gently pulling them off.

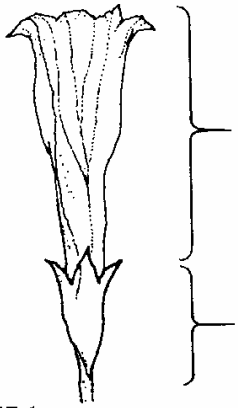


FIGURE 47-1

Two different types of parts should now be seen. The pistil is a single, slender, stalklike structure with a round base connected to the stem (see Figure 47-2). All parts which make up the pistil are associated with a flower's female reproductive system. Also, on the inside of the

petals are stamens. They are also stalklike structures. Each stamen has a two part caplike part on its end (see Figure 47-2). All parts which make up the stamen are associated with a flower's male reproductive system.

A more detailed study of a stamen reveals that it is composed of two parts. The stalk portion of a stamen is the filament. It supports the cap. The cap on the filament is the anther. The anther produces pollen grains.

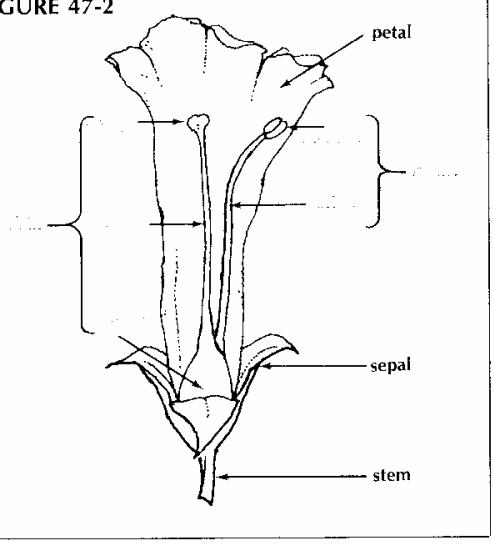
• Label *stamen, filament,* and *anther* in Figure 47-2.

A detailed study of the pistil reveals that it is composed of three parts. The stigma is the top portion of the pistil. It is usually sticky. The stigma is the collecting place for pollen grains. The stalk of the pistil is the style. The style supports the stigma. The base portion of the pistil is the ovary. The ovary may be partly hidden from view by the sepals. If so, remove the sepals by gently pulling them off.

• Label the *pistil, stigma, style,* and *ovary* in Figure 47-2.

1. How many stamens are present in tobacco flowers? _____
2. How many pistils are present in tobacco flowers? _____
3. How does the number of stamens compare to the number of petals and sepals in tobacco flowers? _____

FIGURE 47-2

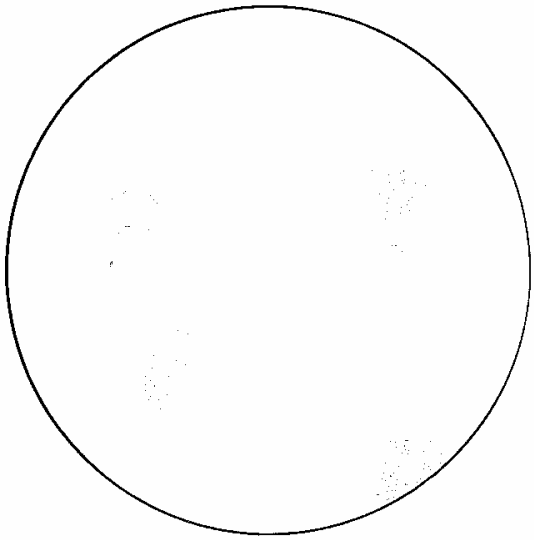


Part B. Microscopic Examination

• Prepare a wet mount of pollen grains. Place an anther onto a slide and add a drop of water. Cut the anther into several small pieces with the razor blade. **CAUTION:** *Blade is sharp. Cut away from your fingers.* Add a coverslip and gently press down to squash the anther pieces.

• Examine the anther under low and high power of your microscope. The small dotlike structures are pollen grains. Pollen grains contain the male sex cells.

• Diagram in the space provided several pollen grains as they appear under high power.



pollen grains

• Using Figure 47-3 as a guide, slice the ovary exactly in half lengthwise with a razor blade.

• Mount one half in a drop of water on a microscope slide. Make sure that the cut surface is facing up.

• Examine the ovary section with a hand lens or binocular microscope. Two structures of the ovary should be visible.

The many small, dotlike structures which fill the two ovary halves are ovules. Each ovule contains an egg cell that is not visible.

A funiculus, a tiny stalk, connects each ovule to the ovary.

• Label the *ovary, ovules,* and *funiculus* in Figure 47-4.

Name _____ Date _____

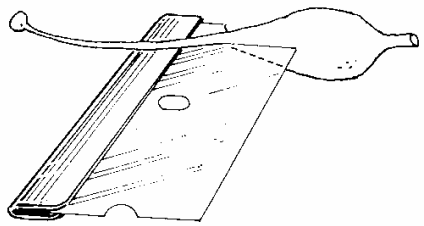


FIGURE 47-3

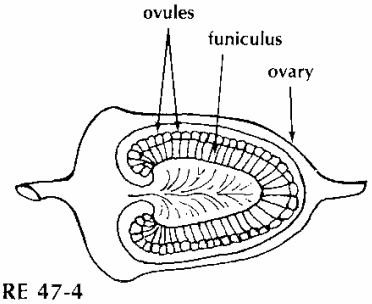


FIGURE 47-4

4. About how many pollen cells are present in each anther? (Make a reasonable guess.)

_____

5. How many ovaries are present in tobacco flowers? _____

6. About how many ovules are present in tobacco flowers? (Make a reasonable guess.) _____

7. (a) Are there more pollen cells produced by one anther than ovules produced by one ovary?

_____

(b) Give a possible explanation for your answer.

_____

_____

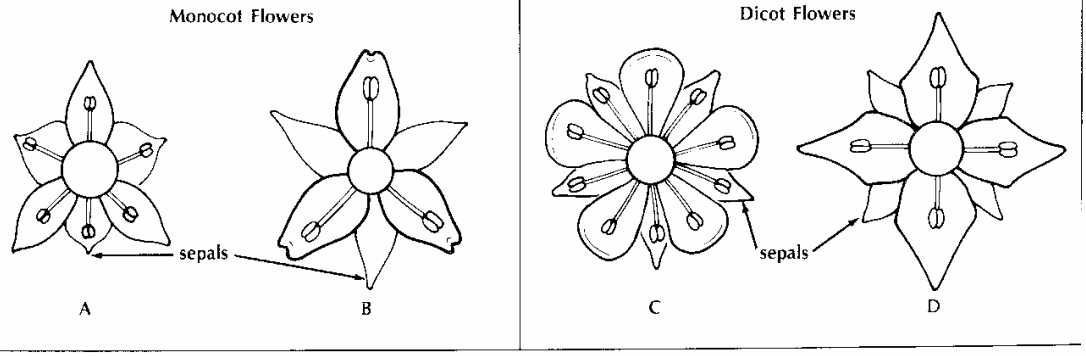
_____

Analysis

1. Give the functions of the following parts.

PART	FUNCTION	PART	FUNCTION
sepal		filament	
petal		style	
anther		pollen	
stigma		flower	
ovule		stamen	

FIGURE 47-5



2. Angiosperms are classified as either monocotyledon (monocot) or dicotyledon (dicot) plants. One difference between these two plant groups is found in their flower anatomy. Use Figure 47-5 to complete the table below.

		NUMBER SEPALS	NUMBER PETALS	NUMBER STAMENS	NUMBER PISTILS	SEPALS, PETALS, STAMENS IN MULTIPLES OF 3, 4, OR 5?
Monocot plant	A					
	B					
Dicot plant	C					
	D					

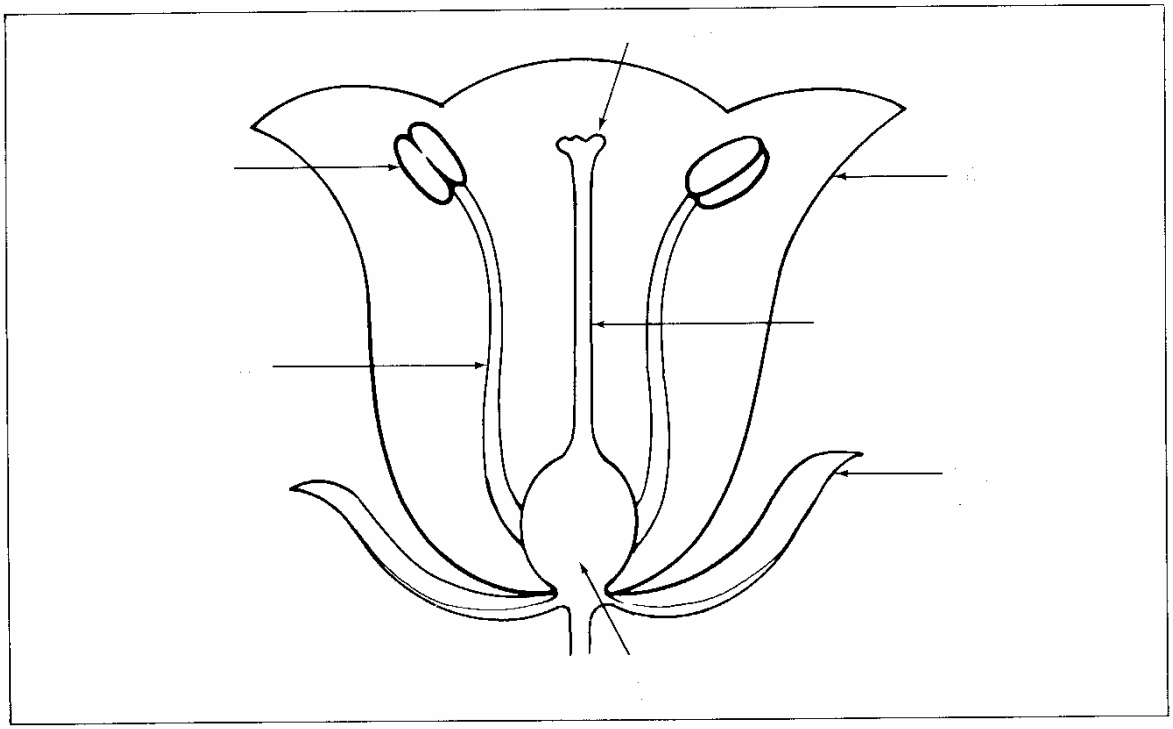
3. (a) Explain how to identify a monocot plant by examining its flowers. _____

(b) Explain how to identify a dicot plant by examining its flowers. _____

4. (a) Using your answer from Question 3, decide if the tobacco flower dissected in Part A of this experiment is a monocot or a dicot. _____

(b) What is your evidence? _____

5. This diagram shows those flower parts found in a typical flower. Label those parts indicated by the arrows. Color the flower's male reproductive parts green. Color the female reproductive parts red. Petals and sepals are neither male nor female; color them blue.



Name _____ Date _____

Fruits And Seeds

48

Fruit formation is an important phase of sexual reproduction in flowering plants. Fruits protect and help distribute seeds. Fruits often are eaten by animals. The seeds enclosed within the fruit are not digested; they pass through the animals. Thus, some seeds are dispersed by animals.

Because they are associated with reproduction, fruits and seeds are related to flower parts. Fruits are enlarged ovaries. Seeds are enlarged and thickened ovules.

In this investigation, you will

(a) examine and compare traits of six different fruit types.
(b) examine the inside parts of a string bean and okra fruit.
(c) examine and compare outside and inside parts of a bean and corn seed.

Materials

string bean
peach
pistachio
peanut
cucumber
green pepper
okra
bean seed soaked in water
hand lens
razor blade (single-edge)
corn seed soaked in water—2

Procedure

Part A. Fruit Comparison

• Examine samples of the fruits listed in Table 48-1. Use a razor blade to cut open the fruits to examine their interiors. **CAUTION:** *Blade is sharp. Cut away from your fingers.*

• Complete Table 48-1. Base your answers on the following brief explanations.

(a) "Nature of fruit" should be either *dry* (hard or brittle) or *fleshy* (soft and usually thick).
(b) "Number of seeds" should be a number. For some fruits (cucumber, green pepper), an estimate rather than an actual number should be given.
(c) "Fruit edible" should be yes or no, considering humans as the consumers.
(d) "Seed edible" should also be yes or no, considering humans as the consumers.
(e) "Evidence of flower parts" should be answered yes or no. A scarlike structure appears on the ends of certain fruits showing remains of reproductive parts no longer present (stigma, petals, and so on). Do not confuse this with the stalk end where the fruit was connected to the plant.

Part B. Fruit Parts

String bean pods are the fruit of a string bean plant. The string bean pod was the ovary of the bean flower. Evidence of this can be seen inside the string bean pod.

• Using a razor blade, cut the string bean pod open lengthwise. Use the "line" found along its outside as a guide.

TABLE 48-1. CHARACTERISTICS OF SOME FRUITS					
FRUIT	NATURE OF FRUIT	NUMBER OF SEEDS	FRUIT EDIBLE	SEED EDIBLE	EVIDENCE OF FLOWER PARTS
Okra					
Peach					
Pistachio					
Peanut					
Cucumber					
Green pepper					

• With the string bean pod open, identify the seeds inside. A small thin stalk can be seen connecting each seed to the fruit or pod. This stalk is the funiculus.

• Correctly add the following labels to Figure 48-1: *fruit, seed, funiculus.*

• Make a cross-sectional slice through an okra fruit. Observe and diagram what you see in the space below. Label these parts: *fruit, seed,* and *funiculus.*

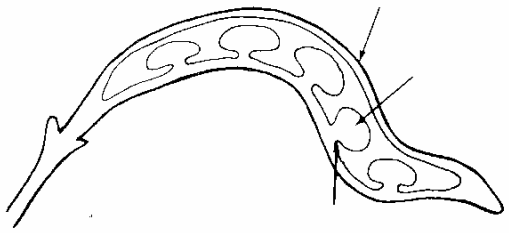
Part C. Seed Parts

• Examine a bean seed that has been soaked in water. Three structures should be visible.

An oval scar on the side of the seed is the hilum. It represents the point of attachment of the ovule by the stalklike funiculus.

The tiny dot directly below (or above) the hilum is the micropyle. It is the opening through which the pollen tube entered the ovule and the egg was fertilized.

FIGURE 48-1



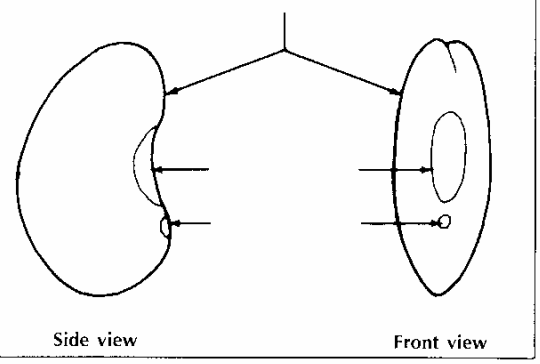
The thick, outer covering of the seed is the seed coat. It protects the seed.

• Correctly add the following labels to Figure 48-2: *hilum, micropyle, seed coat.*

• Using a razor blade, carefully remove the seed coat from your bean seed.

• Open the seed into two equal halves. Four internal structures should be visible with the aid of a hand lens.

FIGURE 48-2



Name _____ Date _____

The bulk of the seed is two cotyledons. They store food which is used by the developing plant during germination.

The other three parts of a seed located near the edge of one of the cotyledons form the young plant. The stemlike structure is the hypocotyl. It will form the stem of the plant. The lower tip of the hypocotyl is the radicle. It will form the roots of the new plant. The small leaflike structure connected to the hypocotyl is the epicotyl. It will form the first true leaves of the plant during its early growth.

• Correctly add the following labels to Figure 48-3: *epicotyl, hypocotyl, radicle, cotyledons.*

• Examine the outside of a soaked corn seed.

1. Can you see the same outer parts as easily on corn as you did on the beans? _____

• Using a razor blade or fingernail, carefully remove the seed coat from your corn seed.

2. Does the corn seed split open easily into two equal halves? _____

Flowering plants are grouped into two categories, monocotyledons and dicotyledons. These groups refer to the number of cotyledons present in the seeds. Mono- means one, di- means two.

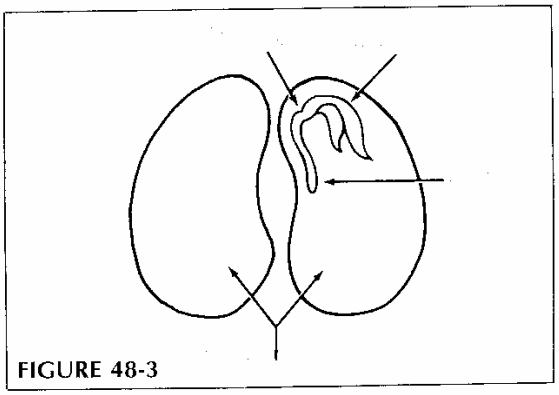


FIGURE 48-3

3. (a) Are beans a mono- or dicotyledon plant? _____

(b) Is corn a mono- or dicotyledon plant? _____

• Cut a second soaked corn seed in half. Use Figure 48-4 as a guide.

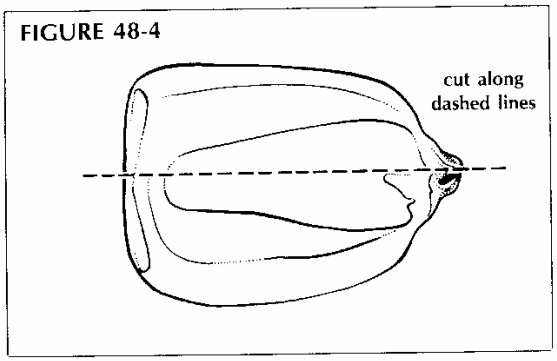


FIGURE 48-4

• Examine the cut edge. Those parts which appear white are the cotyledons, radicle, epicotyl, and hypocotyl. Together these parts form the embryo or future plant. The remaining part is a tissue called endosperm. Endosperm serves as a food source for the young embryo as it first grows. Label the *embryo* and *endosperm* in Figure 48-5.

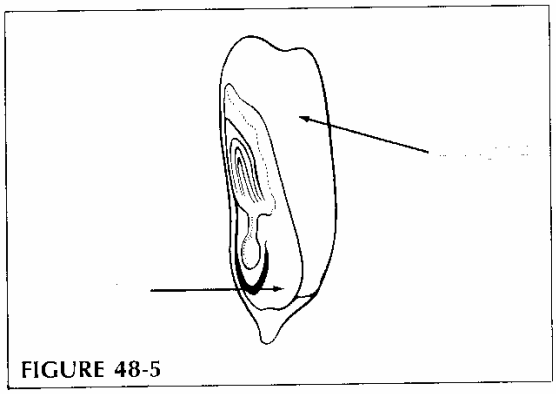


FIGURE 48-5

Analysis

1. Did all fruits examined in Part A have seeds in them? _____

2. (a) Is there a relationship between the nature of a fruit (Table 48-1) and its edibility? _____

(b) Explain. _____

3. (a) Is there a relationship between number of seeds (Table 48-1) and seed edibility? _____

   (b) Explain. _____

4. (a) A string bean pod usually has five to seven seeds in it. How many ovules were present in a bean flower ovary before fertilization? _____

   (b) A tomato may have over 500 seeds in it. How many ovules were present in a tomato flower ovary before fertilization? _____

5. What structure found in string beans, green peppers, tomatoes, and cucumbers tells you that they are all fruits? _____

6. Categorize each of the following plant parts as either fruits or vegetables. (Consider vegetables as a nonscientific category assigned to any plant or plant part other than a fruit.) Give reasons to support your decisions.

   (a) strawberry _____

   (b) beet _____

   (c) squash _____

   (d) pumpkin _____

   (e) lettuce _____

   (f) carrot _____

7. Explain what each of the following parts is or does.

   (a) hilum scar _____

   (b) micropyle _____

   (c) cotyledon _____

   (d) embryo _____

   (e) endosperm _____

8. Explain what becomes of each of the following seed parts as the seed sprouts.

   (a) hypocotyl _____

   (b) epicotyl _____

   (c) radicle _____

9. Define

   (a) monocotyledon (monocot). _____

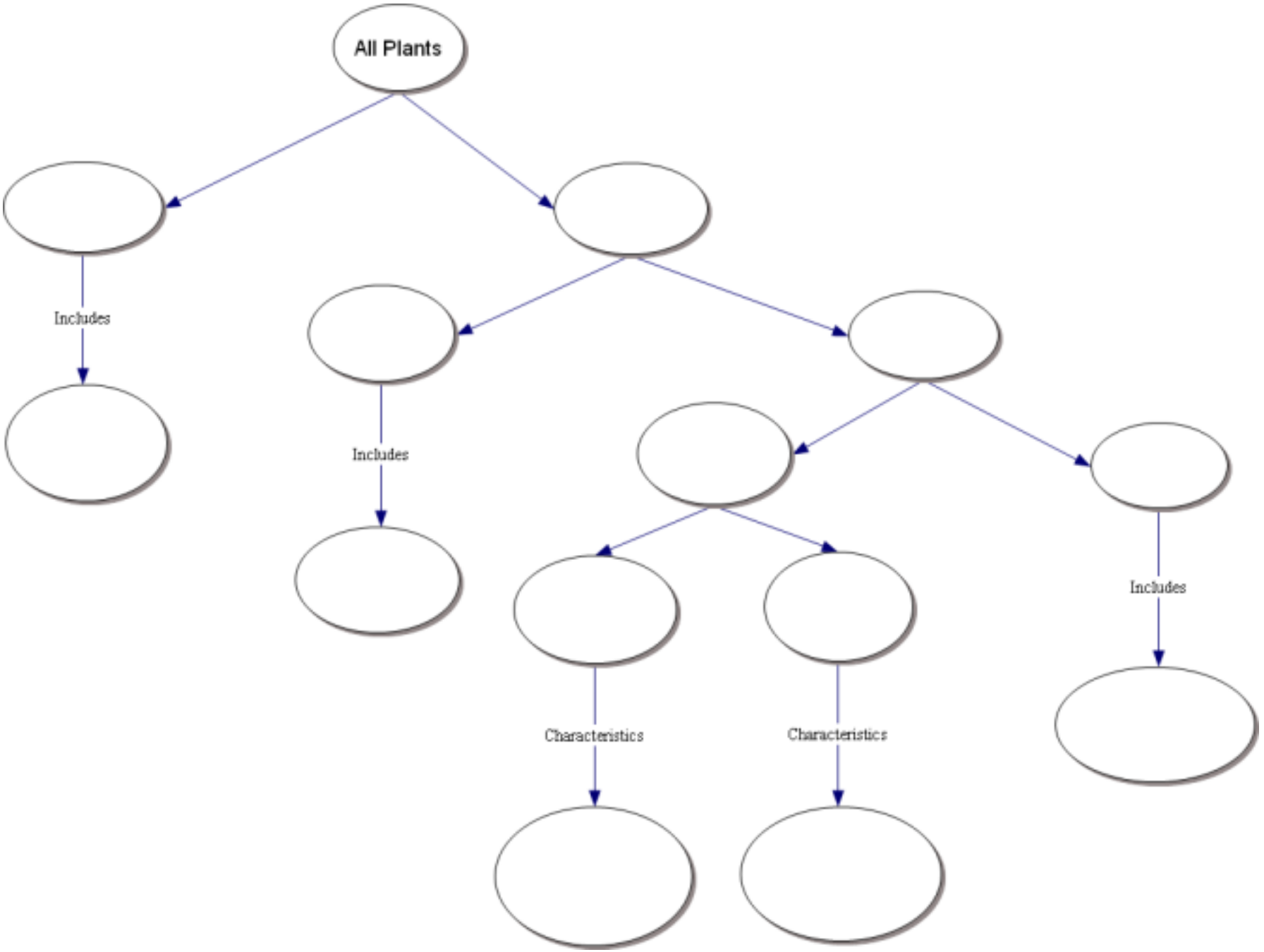
   _____

   _____

   (b) dicotyledon (dicot). _____

   _____

   _____


All Plants
Includes
Includes
Includes
Characteristics
Characteristics

Unit Assessment

It is important to align assessments with learning goals and objectives. This unit does not focus on minutia. Therefore, the assessments will not focus on minutia. Instead, basic content knowledge will be assessed as well higher-order thinking skills.

Every lesson has a corresponding assessment, whether it be notes, writing prompts, activity sheets, or lab sheets. All ensure the aligning of student learning to overall curriculum goals and objectives. In the “Introduction to Classification” lesson, students demonstrate that they understand the concept of binomial nomenclature by answering follow-up questions. In the “Introduction to Dichotomous Keys” activity, students demonstrate that they can use a dichotomous key as well as identify methods used for classification. In the “Create Your Own Key” activity, students demonstrate that they know how to assign species’ names according to the rules of binomial nomenclature and established scientific methods as well as create a dichotomous key. In the “Viruses” lessons, students complete online gizmos in order to portray understanding of the basic characteristics of viruses. This includes identifying what makes viruses non-living. They also participate in the Spread of Disease lab and complete the corresponding activity sheet in order to illustrate understanding of how technology, science, and society are integrated. In the “Hay Infusion” lab, students classify protists as well as identify distinguishing characteristics. In the “Fungus Among Us” lesson, students complete an online virtual museum activity sheet that covers distinguishing characteristics. Lastly, students complete a plant packet that demonstrates the understanding of plant classification as well as distinguishing characteristics of plants in general as well as specific plant groups.

There are two summative assessments (see Table of Contents) which cover (1) classification, viruses, and protists, and (2) fungi and plants. These two assessments evaluate basic content knowledge in addition to application and critical-thinking skills. Both focus on assessing overall goals and objectives, such as requiring students to use a dichotomous key to identify an unknown bird species and distinguishing methods used in classification.

In addition, I will continuously collect informal assessment information by walking around the room, speaking with students, and talking with my cooperating teacher.