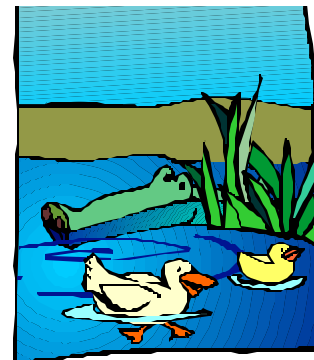


Nicole Hendershot
Jess La Bleu
Fall, 2004



What's in the Pond?

Unit Overview

Abstract: “What’s in the Pond?” is a mini-unit designed to introduce students to microorganisms within a specific ecosystem. Students will have the opportunity to make observations, explore the environment, conduct experiments and draw conclusions through first-hand experience at a pond. This unit is designed to be used in any neighborhood pond. Be prepared to get wet!

Grade Level: Sixth

Utah State Core Curriculum Standards:

Science Benchmark

Microorganisms are those living things that are visible as individual organisms only with the aid of magnification. Microorganisms are components of every ecosystem on Earth. Microorganisms range in complexity from single to multicellular organisms. Most microorganisms do not cause disease and many are beneficial. Microorganisms require food, water, air, ways to dispose of waste, and an environment in which they can live. Investigation of microorganisms is accomplished by observing organisms using direct observation with the aid of magnification, observation of colonies of these organisms and their waste, and observation of microorganisms’ effects on an environment and other organisms.

Standard V: Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.

Objective 1: Observe and summarize information about microorganisms.

- a. Examine and illustrate size, shape, and structure of organisms found in an environment such as pond water.
- b. Compare characteristics common in observed organisms.
- c. Research and report on a microorganism’s requirements (i.e. food, water, air, waste disposal, temperature of environment, reproduction).

Intended Learning Outcomes:

- Use science process and thinking skills
- Manifest scientific attitudes and interests
- Communicate effectively using science language and reasoning
- Understand the nature of science

Unit Duration:

2 ½ Weeks

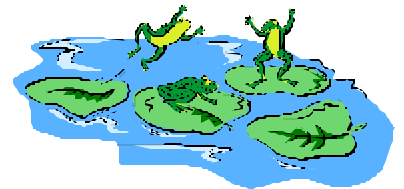
Unit Anticipation Idea: Create posters that have catchy slogans such as “Caution, you may get wet!”; “Beware of the Bacteria”; and “What’s in the water?”. Begin displaying the posters approximately one week prior to the beginning of the unit. Do not explain to students what these posters mean, but allow them to question and make hypotheses about what they think the unit will be.

Opening Lesson Plan: Caution—you might get wet!

Subsequent Lesson Plan: Moldy Lunch

Closing Activity Idea: Students will design and conduct experiments in relation to their experiences at the pond. Students will then present their experiments to their peers, parents and other classes in a visual format as a concluding activity.

Nicole Hendershot
Jess La Bleu
Fall, 2004



Caution—you might get wet!

Abstract: In this lesson students have first-hand experience with a pond and the environment surrounding it through a field trip to a local pond. Students make observations using their five senses, collect plant and organism samples, and test the water. This *is* a field trip and would work best with parent volunteers.

Grade Level: 6th

Utah State Core Curriculum Standards:

Standard V: Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.

Objective 1: Observe and summarize information about microorganisms.

- d. Examine and illustrate size, shape, and structure of organisms found in an environment such as pond water.

Science Benchmark

Microorganisms are those living things that are visible as individual organisms only with the aid of magnification. Microorganisms are components of every ecosystem on Earth. Microorganisms range in complexity from single to multicellular organisms. Most microorganisms do not cause disease and many are beneficial. Microorganisms require food, water, air, ways to dispose of waste, and an environment in which they can live. Investigation of microorganisms is accomplished by observing organisms using direct observation with the aid of magnification, observation of colonies of these organisms and their waste, and observation of microorganisms' effects on an environment and other organisms.

Intended Learning Outcomes:

- Use science process and thinking skills
- Manifest scientific attitudes and interests
- Communicate effectively using science language and reasoning
- Understand the nature of science

Lesson Objectives:

Students will be able to:

- Observe and communicate observations of a pond and its surrounding environment.
- Use technology to explore organisms from the pond.
- Collect samples of plant and animal life from the pond.

Instructional Time:

30 minutes in classroom

1-1 ½ hours at the pond

Materials:

- Clipboards
- Worksheets
- Blank white paper
- Student Journals
- Pencils
- Colored pencils
- Thermometers
- Field Microscopes
- Ziploc bags
- Petri Dishes
- Water Boots

- Clear Tubs
- Pipettes
- Net
- Jars
- Stop Watches
- Chart paper

Terminology:

Pond: a still body of water usually smaller than a lake.

Microorganisms: An organism of microscopic or submicroscopic size, especially a bacterium or protozoan.

Aquatic Invertebrates: Organisms without backbones that live in water such as ponds, rivers and lakes. They may be called the “bugs” that live at the bottom of a river.

Petri Dish: A shallow glass or plastic cylindrical dish with a lid that is primarily used to grow bacteria, but can also be used for seed germination or viewing small organisms.

Background Information and Resources:

As students explore the pond they will undoubtedly have many questions to which you won't know the answers. This is a great website with resources about ponds. There are pictures of microorganisms that your students can use to help identify the organisms they retrieve from the pond. There are also additional pond lesson plans and activities. There's even an outdoor pond classroom if getting to the pond is not an option for your class.

<http://www.uen.org/utahlink/pond/>

Some ponds in Utah Valley include: Draper Pond, Mill Hollow Reservoir, Bountiful Pond, Sugarhouse Park, Red Butte Gardens, and Fairmont Park. The Utah Division of Wildlife Resources also has a list of ponds in all areas of Utah at:

<http://www.wildlife.utah.gov/disabled/fishing.html>

The following website has printable pages about the animals and organisms that live in ponds.

<http://www.enchantedlearning.com/biomes/pond/pondlife.shtml>

This is an excellent pond resource for teachers. The website explains various aspects of ponds including how they are formed, animal life, and plant life. The website also provides links to other great pond websites.

<http://mbgnet.mobot.org/fresh/lakes/>

These websites give links to find information about the different aquatic invertebrates students may encounter at the pond.

<http://info.wlu.ca/~wwwbiol/bio305/Database/classes.htm>

http://www.riverwatch.ab.ca/how_to_monitor/macroinvertebrates.cfm

Classroom Time

This prior knowledge assessment would be most helpful for directing instruction if students were to complete it a few days before the field trip. In doing this, the field trip centers could be adjusted or another could be added to help students explore further the things they already know and to have them discover new ideas.

Prior knowledge assessment:

- Give each student a blank sheet of white paper.

- Have students write the word “pond” in the middle of the sheet.
- Give students 5 minutes to work on their own to make a web of all the things they can think of that are related to a pond. (See worksheet 1 for example)
- Have students number off 1-6. All of the ones will become a group and so on.
- Have students get into their groups and give them 3-5 minutes to share their ideas.
- Finally, create your own web on the whiteboard/chalkboard generating ideas from the students.
- After a class “pond” web has been made ask students to share questions they have about ponds and things that they would like to learn about ponds.
- Record this information on a piece of chart paper that can be used throughout the unit to help students see what they have learned about ponds. This list can be used to develop other lessons for the unit.

Procedures:

- Tell the students that they will get the chance to observe and explore some of the things that they came up with on their webs.
- Tell the students that when we get to the pond, they will have several tasks to complete. They will be working individually and in groups and partners to complete all of the tasks.
- Explain each of the tasks that students will need to do while at the pond.
 - **Task 1: Observing the Pond**
 - This activity will be done individually.
 - Observe the pond from three different places using your five senses.
 - Show students worksheet 2 and briefly review the five senses.
 - **Task 2: Temperature of the pond.**
 - This activity can be done with a partner.
 - Take the temperature of the pond using a thermometer from 3 different areas.
 - Show students worksheet 3 and explain how to fill in the chart.
 - After students have taken the temperature, they will answer the questions: Was the temperature the same in all 3 places?; If yes, why do you think the temperature would be the same in all of the places?; or If no, why do you think the temperature could be different even though the water is from the same pond?
 - Model for students how the thermometers work.
 - **Task 3: Plant Samples**
 - This activity can be done with a partner, but each student will collect samples in his/her baggie.
 - Students will each receive a baggie for this task.
 - Students will walk around the environment of the pond collecting samples of at least 5 different plants they can find.
 - Place the plant samples in your baggie.
 - **Task 4: Observe the water**
 - Students may collect the water with a partner and observe the same jar, but both need to record their own observations.
 - Students will need a small clear jar for this task.

- Students will go to the edge of the pond and collect a jar of water.
- Then they will observe the water and answer the questions on worksheet 4.
- Students will dump the water back into the pond when they are finished observing the water.
- **Task 5: Pond Life**
 - This activity will be done in groups of 4-5 and will need to be facilitated by the teacher or another adult.

PART 1

 - 2 students will put on the water boots.
 - One student will take the net into the water.
 - He or she will hold the net at an angle in the water so that the net is partially submerged.
 - The other person will go into the water and stand up from the net. He or she will stir up the water and sediment in front of the net.
 - The student holding the net will then carefully pull the net out of the water as to keep the collected sediment on the net.

PART 2

 - The other 2-3 students will have the big clear tubs available.
 - The students will gently rinse the net off into a clear tub with pond water.
 - Students will place the tub where they can all see into it.
 - Each student will then take a Petri dish and a plastic pipette.
 - Students will then look carefully in the water for microorganisms and aquatic invertebrates (such as worms, snails, leeches, etc.).
 - **INTRODUCE TERM aquatic invertebrates:** Ask students to observe how the organisms are moving. Ask students if their own bodies can move in the same manner? Why can the organisms' bodies move in every way while our bodies cannot? The organisms do not have a backbone. Have students feel their own backbones. These organisms are called aquatic invertebrates: aquatic meaning water and invertebrate meaning having no backbone.
 - Using the pipettes, students will suck up the organisms and place them in their Petri dishes.
- **Task 6: Observing your organisms**
 - Once students have collected their organisms in their Petri dish, they will move to observing their organisms.
 - Students will use worksheet 5 for this task.
 - Students will first draw their collected organisms.
 - Students will then look at their Petri dishes under the microscope. They will again draw the same organisms, but with more detail that they can see from the microscopes.
 - Students will also compare and contrast the organisms' size, shape and structure.(See worksheet 6)

Getting to the Pond

Students will need to bring the following materials:

Clipboard
Pencil

At the Pond

Invitation to Learn:

Camera Activity:

Model for the students the Camera activity. This activity is designed to get students observational skills going.

One person is the camera and one person is the photographer.

The person who is the camera will close his/her eyes. The photographer will then walk that person to a spot where they want them to take a “picture”. The photographer will tap the person on the shoulder to let them know they can take the “picture” by opening their eyes. The photographer will again tap the person on the shoulder after approximately 5 seconds to “close the shutter”. The photographer and camera will then switch places.

After each student has had the opportunity to be the camera and the photographer, give each student a piece of blank white paper and some colored pencils. Students will then draw the “picture” that they took while they were the camera. Give students about 3 minutes to draw their pictures, but do not allow them to go to the spot. After 3 minutes let the students go look at their picture spots. They will then have about 2 minutes to complete their pictures.

Tell them that this activity helped to get their observation skills going which they will be using during the activities that were explained in class.

Reference: Cornwell, J. (1989). Sharing the joy of nature. Nevada City, CA: Dawn Publications.

Procedures:

- Review each of the tasks briefly and hand out worksheet packets to students.
- Go over some general rules:
 - Do not go in the water unless you have the water boots on.
 - Do not throw things into the water.
 - Stay where you can be seen (outline the perimeter for students to stay within).
- Ask students to review for you what they will be expected to do at the pond.
- Have students get into the groups they were in at the classroom. These are the students with whom they will be working.
- Each group will start with the task corresponding to their group number with the exception of group 6 who will also begin with task 1.
- Allow the students to begin the tasks.
- With the exception of Task 5, students can change activities as they complete other tasks.
- Blow the whistle when you need to call students from another group to task 5.
- Each group should take approximately 10 minutes at task 5, when all students have rotated through task 5, let students know that they have approximately 20 minutes to finish their tasks.

Closure:

Bring all of the students together in a group.
Invite 2-3 students to share something new they learned about a on the field trip.
Once in the classroom, ask students to write about their experience at the pond in their journals.

Assessment:

This activity is based on student observations, so students can turn in their task worksheets that they completed while at the pond.

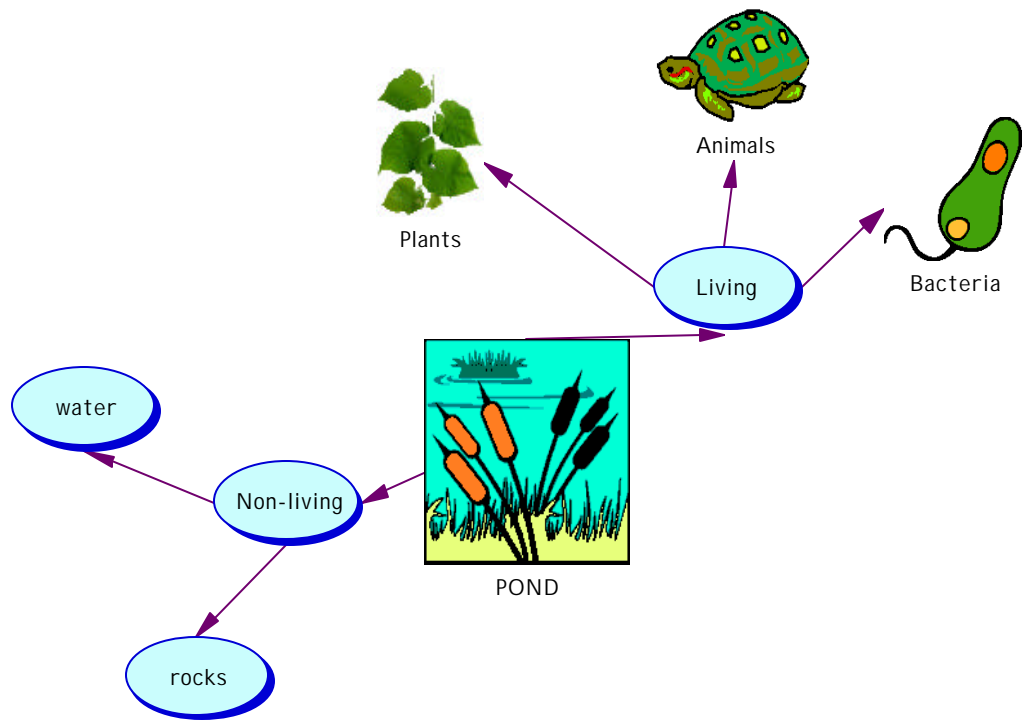
Students will be evaluated on:

- Completing all given worksheets.
- Communicating their observations of the pond using all five senses.
- Drawing accurate pictures of the aquatic invertebrates they collect.
(picture drawn after looking under the microscope is done in more detail than the picture drawn by looking with their eyes).
- Thoroughly comparing and contrasting the size, shape and structure of two organisms. (at least 5 comparisons and 5 contrasts)

Adaptations/Modifications:






This activity has modifications and adaptations built into in that students work in groups and in partnerships. By carefully selecting the partnerships, students with difficulties can be supported by being paired with a strong peer.

Worksheet 1








Observing the Pond


Place 1 _____

Sense	My Observations
 See	
 Smell	
 Hear	
 Touch	
 Tastes it reminds me of	

Place 2 _____

Sense	My Observations
 See	
 Smell	
 Hear	
 Touch	
 Tastes it reminds me of	

Place 3 _____

Sense	My Observations
 See	



Smell



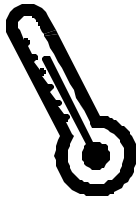
Hear



Touch



Tastes it reminds me of



Worksheet #3
Temperature of the Water

Place Name	Temperature in °F	Temperature in °C

Was the temperature the same in all 3 places?

If yes, why do you think the temperature would be the same in all of the places?



If no, why do you think the temperature could be different even though the water is from the same pond?

Observing the Water



1. What do you see?
2. Draw what you see.
3. Does the water look different than you expected?
4. Do you think there is anything living in your water sample?
5. What would you expect to see if you looked at a sample of your water under the microscope?

Worksheet #5
Observing your Organisms

<p>Just with my eyes</p> 	<p>Under the Microscope</p> 

Worksheet #6
Comparing and Contrasting Your Organisms

Choose two of the organisms you found in the pond.

A. Using complete sentences, write about at least 5 ways the two organisms are similar (compare).

- 1.
- 2.
- 3.
- 4.
- 5.

B. Using complete sentences, write about at least 5 ways the two organisms are different (contrast).

- 1.
- 2.
- 3.
- 4.
- 5.



Moldy Lunch

Abstract: This is a hands-on lesson that gives students the opportunity to conduct a scientific experiment. Students will make predictions, set up experiments, and draw conclusions through observation and questioning.

Grade Level: 6th grade

Utah State Core Curriculum Standards

Standard V: Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.

Objective 1: Observe and summarize information about microorganisms.

Examine and illustrate size, shape, and structure of organisms found in an environment such as pond water.

Intended Learning Outcomes:

- 1 Use science process and thinking skills
- 2 Manifest scientific attitudes and interests
- 3 Communicate effectively using science language and reasoning
- 4 Understand the nature of science

Lesson Objectives:

Students will be able to:

- 1 Set up an experiment
- 2 Make hypothesis about what is going to happen
- 3 Observe and communicate results of experiment
- 4 Use technology to further explore the experiment
- 5 Record results

Instructional Time:

Set up: 1 hour

Experiment: (1 week later) 1 ½ hours

Materials:

- 5 quarters of bread per student (bread w/o preservatives works best)
- Spray bottle of pond water
- Spray bottle of tap water
- Baggies (5 per student)
- Warm, dark place to store experiments
- Paper Towels
- Permanent Markers
- One shoebox per student
- Latex gloves
- Microscopes

Terminology:

- 1 Hypothesis: message that expresses an opinion based on incomplete evidence.
- 2 Bacteria: any group of prokaryotic unicellular round, spiral, or rod-shaped single-celled microorganisms. Live in soil, water, organic matter, or bodies of plants and animals.
- 3 Mold: group of fungi that causes disintegration of organic matter.
- 4 Microorganisms: an organism that cannot be seen with the naked eye.

Background Information:

- Mold begins as a tiny spore that lands on a food source like bread. Spores can be found in the air, on the ground and on you! Watch this video to learn more!
http://www.flowersbakeries.com/kids_bread_mold.html
- Different bacteria are different colors due to the presence of different colored substances in the cells. (Algae are green because they contain chlorophyll, carotenoids color bacteria red or brown, purple and pink bacteria contain different pigments that absorb light at different wavelengths so they appear different colors.
- The color of fungi comes from chemicals that are produced either as a waste, cellular metabolites, digestive agents, or even to create a toxic environment for other fungi. These chemicals can produce colors from very dark brown, greens, blues, reds, oranges, yellows, etc. White molds are clear or colorless. These colors can stain the growing surface and have even been used to produce dyes.
- Molds and fungi need food, water, and proper temperature to grow.
 - o Molds are mostly water – just like humans. They need plenty of moisture to survive.
 - o Molds cannot control their temperature so they grow and develop at the temperature of their environment. The enzymes (proteins) that are found in mold cells work faster in warmer temperatures. About 80° is optimal for mold.
- Molds do not need light for food production because they digest organic matter that is extra-cellular. When molds are in bright light or sun they can dry out.
- Fungi are in their own kingdom of organisms
<http://www.herbarium.usu.edu/fungi/funfacts/Kingfact.htm>
This website contains a graphic that shows the relationship of fungi to other organisms.
- References:
 - o <http://www.seps.org/cvoracle/faq/mold.html>
 - o <http://www.madsci.org>

Preparation Activity:

- Label baggies: tap water, pond water, floor, licking, hands
- Students take each quarter of bread and apply one of the following “treatments” to each quarter:
 1. Wipe both sides of one quarter of bread with your hands. Like you’re spreading mayonnaise on the bread. Place in baggie labeled: Hands.
 2. Hold another quarter in the corner lick both sides of the bread. Place in baggie labeled: Licking.

3. Hold another quarter in the corner and wipe both sides on the floor. Place in baggie labeled: Floor.
 4. Put on a glove. Place another quarter on a paper towel. Mist both sides with tap water—1 squirt per side. Place in baggie labeled: Tap water.
 5. Place another quarter on a new paper towel. Mist both sides with pond water—1 squirt per side. Place in baggie labeled Pond Water.
- Place all 5 baggies in a shoebox and put on the lid.
 - Store shoeboxes in a warm place for 1 week.

Experiment Worksheet 1 — Think about the organisms you found in the pond water. Using your experiences and findings from the pond trip, make a hypothesis about what will happen to the bread this week.

Activity (Occurs 1 week later):

Invitation to Learn:

- Review your hypothesis.
- Make predictions about what you will see when you open your shoebox. Has anything changed? Smells? Colors?
- Would you want to make a sandwich with your bread?
- Why wouldn't the bread look the same as when we put it in the box?
- Thinking about what we discovered about the organisms at the pond, what do you expect to see on the bread with pond water?
- Have students use sticky notes and write down any questions that they have at this point.
- Allow students to take turns reading their questions out loud and sticking them on a T-chart (questions -- answers).
- Leave a pad of sticky notes near the chart so that as questions arise, students can add them to the chart. If a student learns the answer to a question, they can use a different colored sticky note to write the answer, then stick both the question and answer on the 'answers' side of the T-chart.

Prior Knowledge Assessment:

Discuss:

- From your experiences, what happens to food (especially bread) when it is left for long periods of time?
- Why does this happen?
- Where does the mold come from?
- Did you see any evidence of mold or fungus growth at the pond? Where was it located (sunny/shady? wet/dry? rocks/dirt/plants?)
- How do these characteristics compare with the conditions our bread has been in for the past week?
- Remind students to continue posting questions.

Developing a basic understanding of terminology:

Have these three terms written on strips of paper:

- **Bacteria:** any group of prokaryotic unicellular round, spiral, or rod-shaped single-celled microorganisms. Live in soil, water, organic matter, or bodies of plants and animals.
- **Mold:** group of fungi that causes disintegration of organic matter.
- **Microorganisms:** an organism that cannot be seen with the naked eye.

After having students explain what they think each term is, have students match the terms with the definitions. Teacher provide clarity on any misunderstandings.

Procedures:

Naked Eye:

Open your shoebox. DO NOT open your baggies.

Record your observations. (WORKSHEET 2)

- 1 Draw what you see
- 2 Color
- 3 Amount
- 4 Do you notice a growth pattern?
- 5 Write about what you see

Microscopes:

Observe your samples under the microscopes.

- 1 Draw what you see.
- 2 Describe the shape of the bacteria.
- 3 What color(s) do you see?

Compare/contrast your five bread samples.

How are the molds alike?
How are they different?

Revisit your hypothesis:

- Did things happen the way you expected?
- What was different?
- How has your thinking changed?
- How does this process happen in nature (fungi and molds at the pond)?
- What other factors are present in nature that we didn't have in our classroom experiment?

New knowledge:

Discuss questions and answers that have been posted. Remaining questions can be used for student research or topics for the experiments that they will create in the extension activity.

Adaptations and Modifications for Special Learning Needs:

- 1 Students could work in groups of two – each one conducting their own experiment.
- 2 There are visuals on the worksheets to help guide the students understanding.

- 3 This is a very “hands on” lesson.
- 4 A student could complete this project with little hindrance from reading difficulties.

Assessment:

Students will be able to:

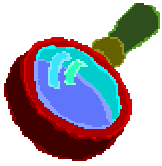
- 1 Set up an experiment
- 2 Make hypothesis about what is going to happen
- 3 Observe and communicate results of experiment
- 4 Use technology to further explore the experiment
- 5 Record results

This will be measured by:

- Completed worksheets
- Reflections, questions, new information recorded in journals
- Active participation in discussions

Name _____

Experiment Worksheet 1



The experiment: _____

Draw the experiment:



Hypothesis:

I think that _____

Because _____

Thinking along the way:

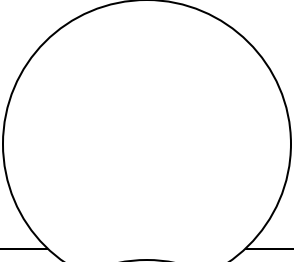
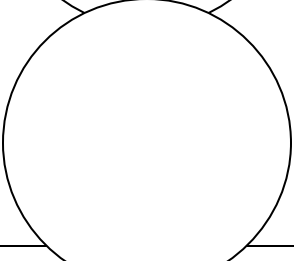
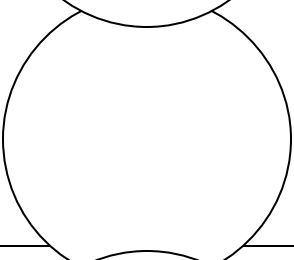
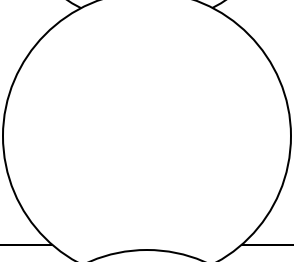
Name _____

Experiment Worksheet 2



“NAKED EYE”

MICROSCOPE

<u>Hands</u> Color(s): Amount: Growth pattern:		Color(s): Describe shape of bacteria:	
<u>Licking</u> Color(s): Amount: Growth pattern:		Color(s): Describe shape of bacteria:	
<u>Floor</u> Color(s): Amount: Growth pattern:		Color(s): Describe shape of bacteria:	
<u>Tap Water</u> Color(s): Amount: Growth pattern:		Color(s): Describe shape of bacteria:	
<u>Pond Water</u> Color(s): Amount: Growth pattern:		Color(s): Describe shape of bacteria:	