Save the Pond
Aimee Webb, Janel Chatraw, Molly Embree, Angela Wade, Mike Amodio

Save the Pond: Scene 1

Parent-Teacher Association
Decatur City Schools
Decatur, GA

[Insert Day 1 Implementation's Date]

Dear Students,

It has come to our attention that the pond on the school grounds is in great disrepair and if not remedied will be filled in and no future pond projects will be funded. Your class has been chosen to lead the 'save the pond campaign'.

We are willing to allot some money to repair and refurbish the pond, but "SAFETY FIRST"!! Before we can let you begin, we must be ensured that you will do everything you can to keep yourself and others safe.

Please let us know the safety guidelines that you will follow while working on the pond and how you will ensure that everyone working on the pond will be safe and follow the rules.

Sincerely,

Joe Q. Public
President

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Save the Pond: Scene 2

Parent-Teacher Association
Decatur City Schools
Decatur, GA

[Insert Day 3 Implementation's Date]

Dear Students,

We were very pleased with the safety guidelines that you created and are satisfied that you and your classmates will be careful and watch out for each other while working on the pond. We are sure you're already full of ideas about what to do with the pond, but we would like to know the current situation of the pond, before improvements are done.

A current assessment will help us understand your future plans better and give us an idea of how much money is needed to make it a great pond. Please return to us a description of the physical aspects of the pond and a description of the living and nonliving things in and around the pond. Also, please point out the problems that will need to be addressed when the time comes to fix the pond.

Sincerely,

Joe Q. Public
President

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Save the Pond: Scene 3

Parent-Teacher Association
Decatur City Schools
Decatur, GA

[Insert Day 11 Implementation's Date]

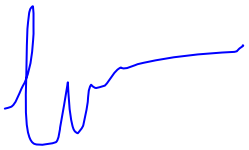
Dear Students,

Wow, the pond is in really bad shape. We didn't realize it was so bad off. Thanks to all of you who braved the mosquitoes and the heat and worked to create such an informative assessment of the pond.

Now comes the fun part – Designing a plan to fix up the pond. You know what's wrong with the pond, so now you have to figure out a plan that will make it better!! Unfortunately, we don't have an unlimited budget – only $200. That means you will have be creative in finding solutions for solving problems and do lots of the research and work yourself.

Specifics for what the plans should include are listed on the next page. Good Luck!!!

Sincerely,



Joe Q. Public
President

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Save the Pond: Station Lab Activity

Objectives:

- Observe and record observations around the pond environment.
- Identify living and non-living things along a *transect line.*
- Suggest which items belong in the pond environment and which do not belong.
- Explain the role of sunlight in the pond environment.

Challenge:

Sketch the pond and its surrounding area. See if you can show the pattern of sunlight and shade around the pond as you observe it.

Materials

Lab sheets, pencil, transect stakes, string, sketch paper, (colored pencils)

Instructions:

1. Set up a transect line.
   Get help from your teacher or facilitator to set up a transect line near the pond. You will use this line to help you make your observations in a systematic, or unbiased, way.

   Start at one end of the transect line, and move slowly towards the other end, making your observations along the way. Use the chart on the next pages to record your observations of living and non-living things

2. Move your transect line 3-5 times to get observations all the way around the pond.

   Each time you move the line, keep one end near the pond and stretch the other end of the string out all the way in a straight line like a spoke from a bicycle wheel.

   Once you fix it in place, continue your observations from one end of the string to the other.

Record new observations in your chart (no need to repeat things you've already listed).

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LIVING	NON-LIVING

4. Which of the things you have observed belong in or around a pond environment, & which do not belong? Use symbols to indicate what belongs & what does not.

   Draw your symbols here:

   "belongs" = "does not belong" =

   Now use your symbols to mark items in your chart.

5. What is the role of sunlight in the pond ecosystem? Which of the living things in the pond depend on sunlight for survival? Do any of the non-living things affect the role of sunlight around the pond? Explain your answer in a paragraph or two.

6. *Challenge*: Sketch the pond and its surrounding area on a separate sheet of paper. Show in your drawing the pattern of sunlight and shade around the pond as you observe it. Use sketch paper and a pencil.

Bonus:
What is a transect line?

What is the purpose of a transect line?

In scientific terminology, what's the difference between a systematic observation and a biased observation?

What's so important about avoiding bias in science?

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Save the Pond: Measurement Lab Activity

Objective: Your team's objective is to estimate the size, area, and volume of the pond. You will work outside at the pond and do all measurements and calculations there.
Please follow all steps in order.

Introduction:

1. You will draw roles at the beginning before going outdoors. The reader will read each role aloud.
    a. Reader: reads each step aloud and makes sure everyone is on task:
    b. Recorder: records all data onto the data worksheet
    c. Handler of Supplies: Obtains necessary supplies, keeps up with supplies throughout lab and returns them to the teacher at the end of the lab. The handler of supplies also performs calculations on the calculator and may help the measurers when necessary.
    d. Measurers: Will perform all measurements and read measurements to the recorder to be recorded in the data worksheet.
2. The recorder will record each team member's role on the data worksheet
3. The supply person will gather the following supplies: yard stick, string, calculator, tape measure, clipboard.
4. With your facilitator, you will all walk out to the pond.
5. At the pond you will begin the actual measurement lab

Measurements:

1. Measure the length of the pond at its longest point and record the length in centimeters on the data worksheet.
2. Measure the width of the pond at its widest point and record the width in centimeters on the data worksheet.
3. Using the meter stick, measure the depth, in centimeters, of the pond in three different places. Record each measurement.
4. Using the three depth measurements, calculate and record the average depth in centimeters.
5. Using the string, measure the circumference of the pond in centimeters. Record your measurement.
6. Using the measurements you have taken, estimate the volume of the pond and record your answer.
7. Using the measurements you have taken, estimate the area of the pond and record your answer.

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Measurement Lab Data Worksheet:

Date: _____

1. Roles
    a. Recorder: _____
    b. Reader: _____
    c. Handler of Supplies: _____
    d. Measurer: _____
    e. Measurer: _____
2. Length: _____cm
3. Width: _____cm
4. Depth:
    a. Location 1 _____ cm
    b. Location 2 _____cm
    c. Location 3 _____cm
    d. Average of three locations _____cm
5. Circumference: _____cm
6. Calculate and record the volume of the pond (Please show all work). Circle your final answer. Don't forget units
7. Calculate and record the area of the pond (Please show all work). Circle your final answer. Don't forget units.

Bonus:

1. Why is the estimate of the volume of the pond not an accurate measurement?

2. What types of measurements and calculations would you need to obtain a more accurate measurement of the pond's true volume?

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Save the Pond: Dissolved Ions Lab Activity

Objective:

The main objective of this lab is to measure the nitrogen level in the pond using tests for nitrate and ammonia and understand the significance of these two compounds in pond water.

1. Draw roles and record each person's role on the data worksheet. The reader will read aloud each person's role.
    a. Recorder: Will record all data on the data worksheet and on the class data chart
    b. Reader: Will read all instructions.
    c. Investigators: Will perform all experiments and handle all samples and equipment (including cleaning)
    d. Taskmaster / Timer: Will keep everyone on task and time any parts of the experiment (the reader may perform this task in smaller groups)

2. Make sure you have all of the following supplies at your station:
    a. 1 plastic pipettes
    b. 2 plastic bags
    c. 1 Nitrate #1 testab
    d. 1 Nitrate #2 CTA testab
    e. 1 Ammonia #1 testab
    f. 1 Ammonia #2 testab
    g. pond water sample
    h. paper towels

Nitrate Test:

1. Using the plastic pipette, fill one of the plastic bags with pond water to line C. Try not to suck up any dirt, plants, or debris.
2. Add 1 Nitrate #1 testab to the bag. Roll the bag down to seal and shake gently for 30 seconds. Do not squeeze the bag!!
3. Open the bag and add 1 Nitrate #2 CTA testab. Roll the bag down to seal and shake gently for 2 minutes. Do not squeeze the bag!!
4. Wait 5 minutes for a red color to develop.
5. Locate the color chart nearest your station and compare your sample with the nitrate color chart.
6. Record your nitrate result as low, medium, or high level of nitrate.
7. Empty the bag in the sink in the front of the room and leave the bag by the sink in its appropriate place.

Ammonia Test:

1. Using the plastic pipette, fill the other plastic bag with pond water to line C. Try not to suck up any debris.
2. Add 1 ammonia #1 testab to the bag and one ammonia #2 testtab to the bag. Roll the bag down to seal and shake gently for 3 minutes. Do not pinch or squeeze the bag!!
3. Wait five minutes for a yellow / green color to appear.

4. Locate the color chart poster nearest your station. Compare your sample with the ammonia color chart.
5. Record the ammonia level in your pond sample as none, medium, or high level of ammonia.
6. Empty the bag in the sink in the front of the room and leave the bag by the sink in its appropriate place.
7. Wipe up any spills and throw away all trash.
8. Answer the questions on the data worksheet.

Nitrate and Ammonia Data Worksheet:

Date: _____

1. Roles:
    a. Reader: _____
    b. Recorder: _____
    c. Investigator: _____
    d. Investigator: _____
    e. Timer and Taskmaster: _____
2. Nitrate level: _____
3. Ammonia level: _____

Answer the following questions:

1. Ammonia and Nitrates are both based on what fundamental element in the periodic table?

2. What are the main sources of ammonia in a pond?

3. What are the main sources of nitrate in a pond?

4. What benefits do ammonia and nitrates provide to a pond environment?

5. What happens when ammonia and nitrate levels are too high?

Bonus:

What are some ways to reduce ammonia and nitrate levels in a pond?

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Save the Pond: pH Lab Activity

Objective: The objective of today's lab is to measure the pH of the pond water using a sample that has been collected for you and to compare the pH of the pond water to the pH of other liquid. You will investigate the significance of pH and how it affects pond life and water quality.

1. Decide on who will perform the following tasks and record those on the data worksheet. If possible do not do the same task you did during the last lab exercise. I
    a. Reader: reads lab instructions aloud to the group will also play role of taskmaster in groups with 4 people
    b. Recorder: records data gathered during the lab into the lab worksheet and on the class poster.
    c. Taskmaster: makes sure everyone is on task; keeps time on timed portions of the lab (needs to have a watch with a second hand). Will also be the reader in groups of four
    d. Investigators: complete the tasks outlined in the lab instructions (may involve handling samples or chemicals, pouring, measuring, etc)

2. Make sure you have the following supplies at your lab station:
    a. 4 Plastic pipettes labeled P, T, L, D
    b. Sample of pond water
    c. Sample of tap water
    d. Sample of lemon juice
    e. Sample of detergent water
    f. 4 pH test tabs (wrapped in foil)
    g. 4 plastic bags
    h. data worksheet
    i. felt tip marker

Lab Instructions (the investigators will work together and handle all supplies and samples):

1. Label one of the plastic bags with a P, the other plastic bag with a T, and so on until each bag is labeled. These bags will be used to hold the different samples.

<u>TapWater</u>

2. Use the pipette labeled T to fill the plastic bag labeled T with tap water to line C on the bag. Do not overfill.
3. Add one pH testab to the bag.
4. Roll the top of the bag down to form a seal and gently shake the bag until the tablet dissolves (this should take less than one minute). DO NOT pinch of squeeze the bag or the test may be damaged!!!
5. Locate the color chart nearest your lab station. Carefully carry the bag to the chart and compare the color of the water in the lab with the colors on the pH part of the color chart. Record the pH that best matches your sample on your data worksheet.
6. Return to your station. One investigator will carry the bag to the sink at the front of the room, empty the water out of the bag, and lay the bag on the table next to the sink (we will wash all the bags later)

Pond Water

7. Use the pipette labeled P to fill the plastic bag labeled P with pond water to line C on the bag. Do not overfill.
8. Repeat steps 3-6 for the pond water sample and record the pH of the pond water on your data worksheet and on the classroom data chart.

Lemon Juice

9. Use the pipette labeled L to fill the plastic bag labeled L with lemon juice to line C on the bag. Do not overfill.
10. Repeat steps 3-6 for the tap water sample and record the pH of the lemon juice on your data worksheet. You do not need to record this measurement on the classroom data chart.

Detergent

11. Use the pipette labeled D to fill the plastic bag labeled D with detergent solution to line C on the bag. Do not overfill.
12. Repeat steps 3-6 for the tap water sample and record the pH of the detergent solution on your data worksheet. You do not need to record this measurement on the classroom data chart.

Answer the following questions:

pH Data Worksheet

Date: _____

1. Record the role of each person
    a. Recorder: _____
    b. Reader: _____
    c. Taskmaster: _____
    d. Investigator: _____
    e. Investigator: _____

2. Record the pH for each of the following:
    a. Tapwater sample: _____
    b. Pond water sample: _____
    c. Lemon juice sample: _____
    d. Detergent solution sample: _____

Answer the following questions as a group:

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1. pH is a measurement of what type of ions? _____

2. The pH scale goes from ___ to ___. Solutions with pH less than 7 are called _____ _____ and solutions with pH greater than 7 are called _____.

3. A neutral solution has a pH of ____.

4. Which of your samples is the most acidic? _____. Which is the most basic? _____

5. How does each of the following affect the pH of a pond?
    e. The number of fish:

    f. The number of plants:

    g. The amount of sunlight:

6. What is the ideal pH range for ponds? _____. Does your pond sample fit this ideal range? _____. If not, what factors in your pond do you think contribute to this difference?

Bonus

1. Lemon juice is _____ times more acidic than vinegar, and orange juice is _____ ____ times more acidic than distilled water (read very carefully for this answer)

2. How does pH relate to ammonia?

3. What types of things can you do if the pH level of your pond drops below an acceptable level – please explain why you would take such actions.

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Save the Pond: Water Temperature & Dissolved Oxygen Lab Activity

Objective: The objective of this lab is to obtain and average water temperature for the pond and determine the concentration of dissolved oxygen in the pond.

1. Draw roles at random and record your roles on the data worksheet. The reader will then read each of the roles aloud:
    a. Reader: Reads aloud all instructions and keeps the group on task
    b. Recorder: Records all measurements and observations on the data worksheet and any necessary measurements on the class data chart. May also serve as sample handler in smaller groups
    c. Investigators: Take temperature readings at the pond and perform tests on the pond sample
    d. Sample handler: Keeps up with all supplies, times activities and collects samples at the pond site (may also serve as recorder in smaller groups)

2. Make sure that the following supplies are at your lab station:
    a. Three thermometers
    b. Plastic container for collecting a pond sample
    c. Data worksheet and clipboard
    d. 1 Glass test tube
    e. two D.O. test tabs
    f. timer or watch with minute hand
    g. several pairs gloves
    h. paper towels

Temperature Measurement

1. With your facilitator, take the three thermometers, the plastic container, gloves, timer, paper towels and the data worksheet and clipboard out to the pond.
2. Three persons (the investigators and the sample handler or reader – not the recorder) will put on gloves and at the same time measure the temperature of the pond in three different sites. To measure the temperature, remove the thermometers from their plastic containers and submerge the end of the thermometer in the water for one minute. Remove and tell the recorder the exact temperature in degrees Celsius. The recorder will record the temperatures in degrees Celsius on the data worksheet.
3. Using the three temperature measurements, calculate and average temperature in degrees Celsius for the pond. Wipe off the thermometers with the paper towels and return them to their plastic cases.
4. The sample handler, wearing gloves, will fill the plastic container half full with water and carry it back to the classroom. LEAVE GLOVES ON for the next part.

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Dissolved Oxygen

1. While wearing gloves, remove the cap from the glass test tube and submerge the tube below the surface of the pond water sample. Make sure there are no air bubbles in the tube.
2. Remove the tube from the water. The tube should be full to the very top of the tube.
3. Add two D.O. testabs to the tube. Some water will spill out and that is OK. Just wipe up the excess with paper towels and throw them away at the end of class
4. Carefully screw the cap onto the tube. More water will spill out of the tube.
5. Slowly invert the tube back and forth until the tablets disintegrate (about 4 minutes).
6. Wait five minutes or until an orange or pink color develops
7. Locate the Color Chart poster nearest you station and compare the water in your tube with the color chart. Record the result as None, Low or High level of dissolved oxygen on your data worksheet.
8. The sample handler will take the plastic container and the glass test tube to the sink at the front of the room and empty the contents in the sink. Place the test tube in the marked box and the plastic container on the table.
9. Clean up any spills, and throw away all trash in the trash can.
10. Answer the questions on the data sheet.

Pond water temperature and dissolved oxygen data worksheet

Date _____

1. Record each person's role
    a. Reader: _____
    b. Recorder: _____
    c. Investigator: _____
    d. Investigator: _____
    e. Supply Handler: _____

2. Temperature of the Pond:
    a. Site one: _____ ^{o}C
    b. Site two: _____ ^{o}C
    c. Site three: _____ ^{o}C
    d. Average temperature _____ ^{o}C

3. The level of dissolved oxygen in our pond sample was _____.

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Answer the following questions:

1. How are dissolved oxygen and temperature related?

2. What are the different sources of dissolved oxygen?

3. What is an adequate dissolved oxygen level for fish to survive?

4. How do the levels of dissolved oxygen change throughout a day?

Bonus

1. Would you expect the dissolved oxygen level to be higher in mountain stream or a small pond? Why?

2. What types of things can you do to increase the dissolved oxygen in your pond?

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Save the Pond: Pond Assessment Guide

	Day 1	Day 2	Day 3	Day 4	Class average
pH					
Dissolved oxygen					
Nitrates					
Ammonia					
Pond Length (cm)					
Pond width (cm)					
Pond depth (cm)					
Circumference (cm)					
Organisms					

1. Please calculate the class average for the different pond measurements. Record them in the appropriate column in the table.
2. Please comment on each of the following: pH, nitrates, ammonia, dissolved oxygen. Be sure to answer the following questions for each measurement: Are your values consistent with a healthy pond? What types of values were you expecting for each measurement? Were any of your values surprising? Why do you think you got the values you did? Do any of your measurements need to be higher or lower? Why?
    a. pH

b. nitrates

c. ammonia

d. dissolved oxygen:

3. Please comment on the size and location of your pond. Is it too small, too big, too deep, too shallow, or just right? Is its location good or should it be moved -- why?

4. Please comment on the organisms and other items observed in or near the pond. What nonliving things don't belong in / near the pond? What living things in the pond might pose a problem to the health / safety of the pond or students? What types of living things need to be in the pond (or need to remain in the pond) to make it a healthy pond? Are there safety concerns with the current way the pond is set up?

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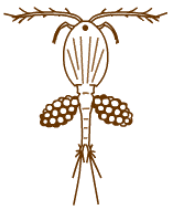
Save the Pond: Biological Characteristics Web Quest

A Virtual Pond Dip - http://www.microscopy-uk.org.uk/ponddip/index.html

1. Find the organisms scientific name, common name (not all have a common name!), where to find them and one thing you find interesting about it. To find the interesting information go to "Further details."

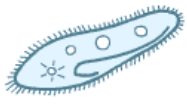
Scientific name: _____
Common name: _____
Where found: _____
Interesting information: _____
_____
_____

Scientific name: _____
Common name: _____
Where found: _____
Interesting information: _____
_____
_____



Scientific name: _____
Common name: _____
Where found: _____
Interesting information: _____
_____
_____

Scientific name: _____
Common name: _____
Where found: _____
Interesting information:
_____
_____
_____



Scientific name: _____
Common name: _____
Where found: _____
Interesting information: _____
_____
_____

Scientific name: _____

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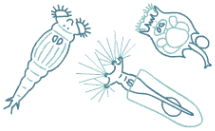
Common name: _____
Where found: _____
Interesting information: _____
_____
_____

Scientific name: _____
Common name: _____
Where found: _____
Interesting information: _____
_____
_____



Scientific name: _____
Common name: _____
Where found: _____
Interesting information: _____
_____
_____

Scientific name: _____
Common name: _____
Where found: _____
Interesting information: _____
_____
_____

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Go to "The Smallest Page on the Web" **http://www.microscopy-uk.org.uk/index.html?http://www.microscopy-uk.org.uk/pond/**. See if you can identify the different organisms. Look for new information on the one you have found. Take notes below.

Organism name:_____
Notes:_____
_____
_____

Organism name:_____
Notes:_____
_____
_____

Dissolved Oxygen: Go to this website
http://www.ncsu.edu/sciencejunction/depot/experiments/water/lessons/do/

1. What does dissolved oxygen in the water measure?
   _____
   _____
2. What should the dissolved oxygen level be for a healthy pond?
   _____
3. What two ways can oxygen enter the water?
   _____
   _____
4. What happens when dissolved oxygen levels decrease?
   _____
   _____
5. What 3 things can cause dissolved oxygen levels to change or vary?
   _____
   _____

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Thinking question

During photosynthesis, plants use carbon dioxide and let out oxygen. This is opposite for humans and animals. We use oxygen and let off carbon dioxide. Given this fact, what would happen to the dissolved oxygen levels in our pond if all of the plants were removed or killed?

_____

_____

_____

Coliform bacteria

Go to: http://en.wikipedia.org/wiki/Fecal_coliforms and scroll down until you reach the **fecal coliform** section.

1. Where do coliform bacteria come from?

   _____

   _____

2. Name one good thing coliform bacteria do.

   _____

   _____

3. What are pathogenic organisms?

_____

_____

4. Why should we measure coliform bacteria in our pond if they are not "pathogenic"?

   _____

   _____

5. Based on what we will be doing with our pond, and using the table on the website, what do you think a dangerous level of coliform bacteria would be?

   _____

   _____

6. Do you think the level of coliform is something we should measure in our pond? Why or why not?

   _____

   _____

Measuring pH

Go to: http://www.therouge.org/Programs/REP/chemical_monitoring.htm#pHtest

1. Use this drawing and label which pH values are neutral, acidic, and basic

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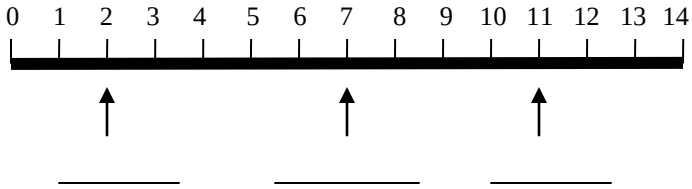


2. If the pH is acidic, does that mean that there are more H^+ ions or more OH^- ions?

   _____

3. What pH is a normal range for natural water in the US?

   _____

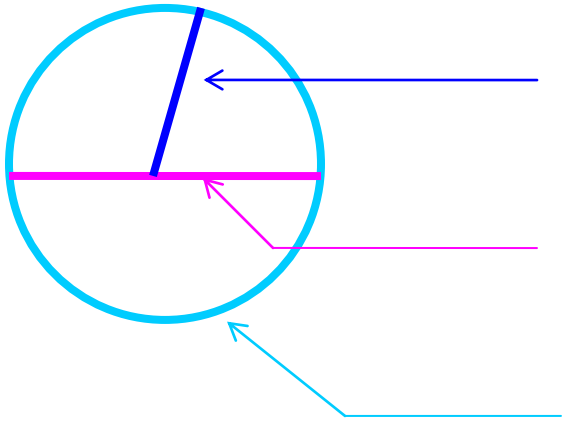
4. What do you think the pH in our pond should be?

   _____

Measurement

Go to: http://www.1728.com/diamform.htm

1. Use this circle and label the circumference, radius and diameter



2. If we wanted to find the surface area (or circle area) of our pond, we would need to get some measurements first. What measurement(s) would we need to have?_____
   _____

3. What if we wanted to know the volume of water our pond held? What measurements would we need to obtain?_____
   _____