PETERSON'S POND

A simulation of solving a scientific mystery while learning about a pond's ecosystem

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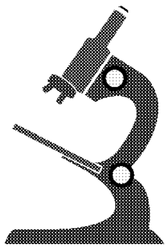
PURPOSE

While using the scientific



method …

Your students become scientists in order to solve an environmental mystery. They work to determine why a large number of creatures have been dying recently in a nearby pond. As a result of this simulation, students become better prepared to conduct and understand scientific investigations. While using the scientific method during the simulation, they learn to observe, draw conclusions from factual information, and carefully write their conclusions in a science journal—just as scientists do. Specifically, your students will gain the following:

Knowledge

1. Characteristics of a pond with its plants and animals
2. Steps of the scientific method
3. Importance of a science journal as a place for all information gained during scientific experiments and observations
4. Importance of a microscope to scientific inquiry

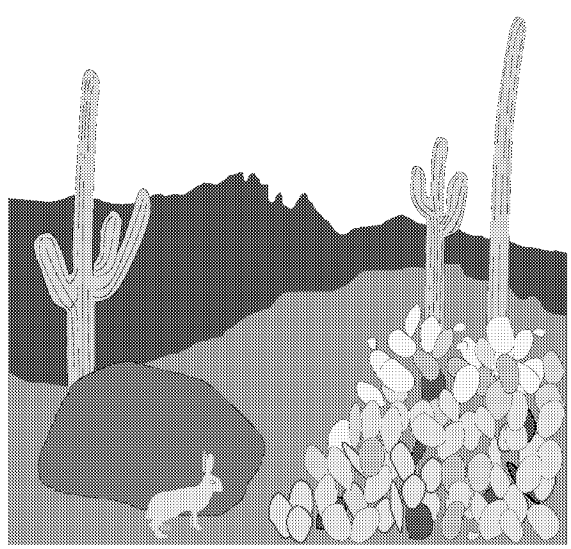
Skills

1. Conducting experiments using the scientific method
2. Using a microscope to gain more detailed information about life in the pond
3. Accurately collecting and recording scientific data, observations, and questions in a journal

Feelings and Attitudes

1. Developing a sense of teamwork among group members and within the entire class
2. Appreciating the learning that took place doing this simulation by keeping and studying the science journal
3. Gaining confidence in using the scientific method
4. Realizing the necessity of protecting the delicate balance of natural ecosystems

… appreciating the delicate balance



of natural ecosystems …

OVERVIEW - 1

… exposes your students to a scientific mystery …

Most students are fascinated by mysteries because they are able to take pieces of information and see how they fit together as they attempt to solve a problem. Unfortunately, some students have the impression that all mysteries are connected with murder and suffering because that's what they have been exposed to in television and movies. Students need to realize that mysteries are worked on and solved daily in science, history, health, engineering, and in many other disciplines. PETERSON'S POND is a simulation which exposes your students to a scientific mystery. As they use the scientific method during this simulation, they have the opportunity to work as scientists do to solve a real mystery. This simulation excites and challenges students as they *actively increase* their understanding of the scientific process. Students are motivated and excited as they uncover clues and gain information, much like a detective does.

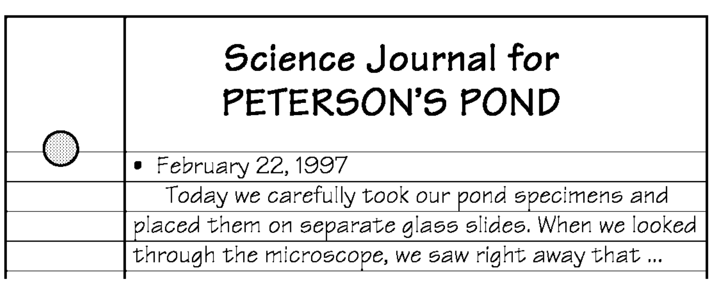
PHASE 1: BACKGROUND

Scientific Method This first phase offers a number of optional activities to provide your students with the background knowledge necessary to work successfully through the entire simulation. These activities expand students' knowledge about the scientific process, the importance of carefully recording observations and experimental notes in a science journal, and the skills necessary to use a microscope. You decide which, if any of these activities, your students will need in order to complete Phase 2.

PHASE 2: THE SCIENTIST AS DETECTIVE

Laboratory Explorations This phase, the main portion of the simulation, may be the only phase you choose to do. Divided into teams, students participate in a variety of laboratory explorations to determine why a large number of creatures in a local pond are dying. These laboratory explorations include learning about pond habitat, food webs present in a pond, water pollution explorations, microscopic observations of the pond, and the pH level of the pond's water. In each laboratory exploration, students use the scientific process and keep a careful record of all scientific observations and experiments in their science journals.

… keep a careful record



of all scientific observations …

T.E.A.M. ACTIVITIES Groups of students also participate in daily group problem solving sessions, called **T.E.A.M.** ACTIVITIES (**To**-gether **E**veryone **A**ccomplishes **M**ore) which provide additional information about pond creatures and pond habitat. Also, students receive daily updates from Richard Peterson, the pond's owner, including five daily clues to help solve the mystery. At the end of each day, during a short debriefing session, students discuss what was learned during that day. After working on the five sessions in Phase 2, students are able to solve the mystery. The final debriefing session during this phase asks students to reflect on what they have learned.

PHASE 3: CHALLENGE PROJECTS (OPTIONAL)

"… take information learned in this simulation one step further …"

Challenge Projects If you have the class time and are interested in having your students take information learned in this simulation one step further, use this phase. It has a number of suggestions to extend the learning beyond the laboratory explorations that took place during Phase 2.

SET UP DIRECTIONS - 1

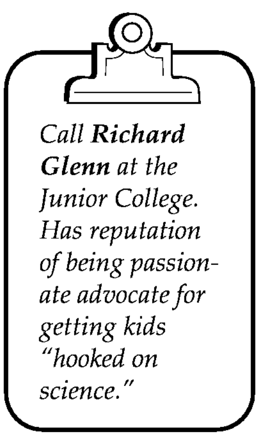
1. **Preparation reading** Carefully and thoroughly read this Teacher Guide and its Student Guide *before* beginning. Doing so will help you plan your time and adjust the simulation to meet your students' needs/abilities.

2. **Science journals** Each student in the class will need a science journal. These journals can be made in a number of ways. The cover (on page 39 of the Teacher Guide) can be copied for each student and can be attached to the front of a composition book. You could also design a journal by folding a large (11 x 16 inch) piece of construction paper in half, gluing the science journal cover on the front, filling the journal with lined paper, and stapling it together.

3. **Study trip** If there is a pond nearby, visit the pond sometime during this simulation. If possible, videotape or photograph the pond during different seasons of the year and show your students how the pond environment changes during the course of a year.

4. **Replicating a pond environment** An optional activity that you may choose to do is to create a pond environment in your classroom. This activity is beneficial if no pond is near for your class to visit. Directions describing how to set up this replicated pond environment are given on page 11.

5. **Guest speakers** If possible, enhance this unit by inviting a scientist with biology expertise to come and speak to your class during or after the simulation. A guest speaker might be found at a local university, high school, college, or business. ***Note**: Students who understand the Internet also might surf the net for information about ponds. Maybe there's a biology professor out there willing to "talk" to your students via computer.*



6. **Schedule** The schedule in this simulation is unique. You should take the time to carefully look through each phase of this simulation to determine how it should best be used in your classroom. The UNIT TIME CHART is written with the assumption that you will work on this simulation an hour every day. It will last one week if you do only the main portion of the simulation (Phase 2). If your students need some background knowledge before starting this simulation, it will last one more week. Phase 1 contains activities to develop some scientific skills that will be useful during Phase 2.

   ***Note**: If you decide to have your students take what they learn in this simulation one step further, add the time you think would be needed for your class to complete the optional Phase 3.*

SET UP DIRECTIONS - 2

7. **Phase 1 Visitation** If you decide to do this optional phase, arrange to have two people visit your classroom for a very brief period of time during the first day. One of these people should be familiar to your students (such as the principal, the secretary, a teacher in a primary grade, etc.). The second person should be a person who is not familiar to your students (such as a friend outside school or a senior citizen who is willing to come to school).

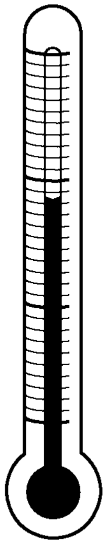
8. **Duplication** Make copies of the following pages. The **M**aster number is given in parentheses. The quantity to duplicate is indicated in *italics*. ***The master pages for you to duplicate begin on page 39.***

Teaching Tip

Duplicate these in advance and place items in separate folders for ready access.

Phase 1:
- MY SCIENCE JOURNAL COVER (**M1**)—*class set*
- SCIENTIFIC METHOD CHART (**M2**)—*class set*
- GRAPHING FORM (**M3**)—*class set + overlay master*
- MICROSCOPE DIAGRAM (**M4:1**)—*class set + overlay master*
- MICROSCOPE DIAGRAM KEY(**M4:2**)—*overlay only*

Phase 2:
- POND CLUES SETS (**M5:1** & **M5:2**)—*one set of 25 clues per group*
- T.E.A.M. ACTIVITY #1 (**M6:1** & **M6:2**)—*one set per group*
- T.E.A.M. ACTIVITY #1 RECORDING SHEET (**M7**)—*one per group*
- SCIENTIFIC DETECTIVE REPORT FORM (**M8**)—*class set + overlay master*
- T.E.A.M. ACTIVITY #2 (**M9:1** & **M9:2**)—*one set per group*
- T.E.A.M. ACTIVITY #2 RECORDING SHEET (**M10**)—*one per group*
- T.E.A.M. ACTIVITY #3 (**M11:1** & **M11:2**)—*one set per group*
- T.E.A.M. ACTIVITY #3 RECORDING SHEET (**M12**)—*one per group*
- T.E.A.M. ACTIVITY #4 (**M13:1** & **M13:2**)—*one set per group*
- T.E.A.M. ACTIVITY #4 RECORDING SHEET (**M14**)—*one per group*
- T.E.A.M. ACTIVITY #5 (**M15:1** & **M15:2**)—*one set per group*
- T.E.A.M. ACTIVITY #5 RECORDING SHEET (**M16**)—*one per group*



9. **Materials needed** Carefully look over the materials needed in this simulation. Notice that this list is divided into two parts: materials needed for Phase 1 (which is optional) and materials needed for Phase 2. Gathering these materials ahead of time will help your simulation run smoothly in your classroom.

PHASE 1

- Glass jars (3 of the same size large enough to hold a cup of water)
- Funnels (3 of the same size in plastic or metal)
- Coffee filters (30)
- Sand (9 cups)
- Potting soil (9 cups)
- Gravel (9 cups)
- Measuring cups (3 one-cup)
- Water
- Ice
- Hot pot (or method to heat water)
- Thermometer
- Microscopes (at least 6 or as many as one for every pair of students in your class—if possible)
- Salt (1 teaspoon)
- Sugar (1 teaspoon)
- Slides (4 for each microscope you have)
- Cover slips for each slide you have
- Things to look at under the microscope such as: onion skin, leaf, small seeds, water droplet, piece of hair, clipping from newspaper or magazine, thin small piece of potato, etc.
- Toothpicks (1 box)
- Paper towels
- Beakers or small containers like baby food jars
- Litmus test tabs or pH paper (1 for each student in the class)
- Color-coded pH charts (6-10) (See **Phase 1: Day 5–Procedure** regarding directions for students to make their own pH charts.)
- Things to test for pH: tap water, milk, cola or soda pop, orange juice, lemons, grapefruit, apple juice, vinegar, liquid soap, shampoo, cream rinse, eggs, household cleaning products

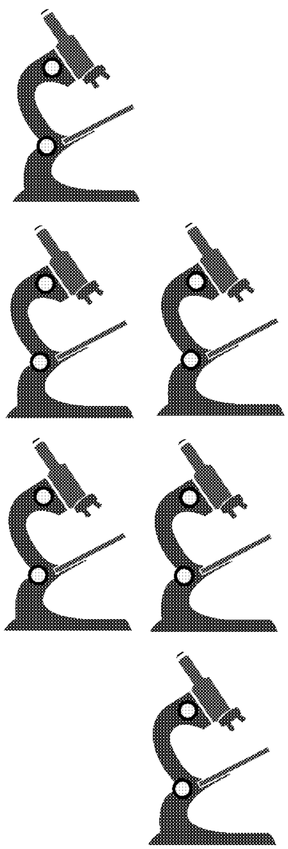
Teaching Tip

Litmus test tabs or pH paper can usually be found in teacher supply stores.

Teaching Tip

Obviously you must carefully find and store all these Phase 1 and Phase 2 materials well in advance.

***Note**: Consider enlisting the aid of students and parents with an appropriate **HELP ME letter** you send home to parents.*



PHASE 2

- Microscopes (6 or more if possible)
- Pond water (1/2 cup of sample kept in a jar with a lid—if pond water is not available, use water from an established freshwater fish tank)
- Slide and cover slip for each microscope
- Eyedroppers (12)
- Cotton swabs (200)
- Clear cups (30)
- Masking tape
- Permanent marker
- Drinking water
- Sugar (12 tablespoons)
- White vinegar
- Salt (6 tablespoons)
- Plastic wrap
- Rubber bands (30)
- Coffee filters (6)
- Baby food jars (12)
- Wax paper
- Magnifying glasses (6 or more, if possible)
- Paper towels
- Litmus test tabs or pH paper (1 for each student in the class)
- Color-coded pH charts (6)
- Baking soda (24 tablespoons)

AUTHENTIC ASSESSMENT

Authentic Assessment
can result in genuine, authentic self esteem

What is authentic assessment? Many teaching methods achieve authentic assessment, some of which have been incorporated into PETERSON'S POND. Authentic assessment involves looking at more than a single test to judge a student's ability in an area of study. Before judging a student's work, it helps to look at his/her progress over a period of time. At the end of a unit of study, a student should be able to show thoughtful understanding of a complex idea. A student can demonstrate knowledge and skills orally, in writing, and through photographs, videos, and projects. Interact simulations are ideal tools to use for authentic assessment because an emphasis is placed upon students facing challenges and then producing something to demonstrate their accomplishments.

Achieving authentic assessment In this simulation, students accomplish a great deal. They use and understand the scientific method, and acquire skills and knowledge which will benefit them throughout their lives. They write down thoughts, ideas, observations, and experiments in a science journal. After the simulation has been completed, you may want to use each student's science journal as an assessment tool to determine and to demonstrate to parents what learning has taken place.

You take time in PETERSON'S POND to observe how students work together in their groups during daily T.E.A.M. group problem solving. During the daily debriefing session, students also give evidence of what they learned during that session and provide you with information on how well they are understanding concepts covered that day. If additional discussion is needed, you have the opportunity to provide that *immediately*. Of course, having students complete daily science activities to your satisfaction is a type of authentic assessment.

Extensions Finally, you may decide to have certain (or all) students do an extension on this simulation as described in the optional Phase 3. Students put the skills they learned in this simulation to practical use as they work on one of the options described. (Students may also develop their own extensions.) A completed phase 3 project is an ideal way to demonstrate authentic assessment.

Final essay If you choose not to have students complete an extension project (as described in phase 3), ask students to write an essay at the end of Phase 2. This essay will demonstrate to each student, you, and others that learning has taken place. As a result, your students will feel a sense of closure and accomplishment; this feeling, of course, is an example of *genuine, authentic self-esteem*.

RESOURCES (ORGANIZATIONS)

For information concerning environmental conservation, students or teachers can write to the following organizations:

1. **Friends of the Earth**
   539 7th St. SE
   Washington, D.C. 20003

2. **U.S. Environmental Protection Agency**
   Office of Communications and Public Affairs
   01 M St. SW, PM211B
   Washington, D.C. 20460

3. **Kids for Saving the Earth**
   P.O. Box 47247
   Plymouth, MN 55447-0247

4. **World-Wide Fund for Nature**
   1250 24th St. NW
   Washington, D.C. 20037

5. **The Wilderness Society**
   1400 Eye St. NW
   Washington, D.C. 20005

REPLICATING A POND ENVIRONMENT

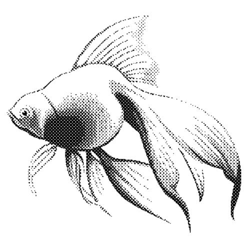
If there is no pond in your area, you may want to create a replica of a pond in your classroom. This optional activity will allow your students to have a close-up view of pond creatures. It is important that the environment you create is not overcrowded, in order that the animals have enough oxygen and your students will easily be able to view creatures in the environment.

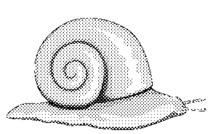
Teaching Tip

Note: Although all creatures found in a pond won't be represented in your replicated pond environment (e.g., ducks and insects), students will benefit from their close observation of the creatures you are able to add to your classroom pond.

To create a pond environment, you will need the following materials:
- Aquarium (1)
- Soil or gravel to cover two inches on the bottom of the aquarium
- Rocks (2 or 3)
- Plants to put in aquarium (those sold in a local fish store are fine or specifically look for pond weed or arrowhead plants)
- Goldfish
- Flake fish food
- Snails
- Frog eggs or tadpoles

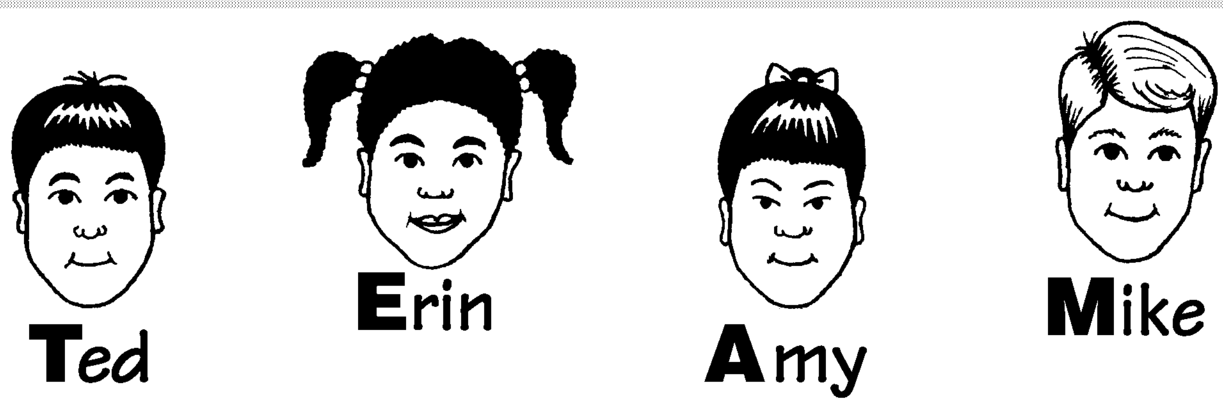
Follow the steps below to create a replicated pond environment in your classroom:
1. Find a sturdy table or counter since an aquarium filled with water is very heavy.
2. Put soil or gravel in the bottom of the aquarium.
3. Place rocks on top of the soil or gravel in various spots.
4. Add water to the aquarium. If you are using tap water, allow the water to sit for 24 hours before adding plants, snails, or fish. This delay allows the chlorine in the water to evaporate. Purified deionized water does not need to sit; it can be added to the tank when the water level drops. If tap water is to be added when the water level drops, allow it to sit for 24 hours before adding it to the tank.
5. When adding plants to the aquarium, be sure to lodge each plant firmly in the gravel or soil. Plants are important because they add oxygen to the water and they give animals a place to hide.
6. Add goldfish and snails to the tank. Since goldfish can survive in stagnant water, they are the ideal fish to use if no air pump has been added to the tank. Snails are also helpful in a pond environment because they eat the algae that will grow in the tank.
7. If possible, add frog eggs or tadpoles to the tank. Frog eggs (spawn) take about 12 weeks to develop into frogs. Spawn eat algae at first, but later they need small amounts of meat. (A small amount of wet dog food or cat food will work.) As soon as the frogs develop four legs, they must be able to get out of the water and should be removed from the tank.
8. Don't put the tank in direct sunlight. Keep the temperature of the tank at approximately 76 degrees Fahrenheit.





UNIT TIME CHART

Monday	Tuesday	Wednesday	Thursday	Friday
Phase 1: Observation activities Science journal Introduce the scientific method Begin experiment **1**	Continue experiment from Day 1 Discuss variables Review the scientific method Science journal **2**	Microscope parts Practice using the microscope Science journal **3**	Continue using the microscope Science journal **4**	pH introduction pH testing of variable substances Science journal **5**
Phase 2: Introduce R. Peterson (note) Create teams T.E.A.M. ACT. #1 Pond Clues 1-5 Microscopic observations DET. REPORT Daily Debriefing **6**	T.E.A.M. ACT. #2 Examine map P's Pond Pond Clues 6-10 POLLUTION ACTIVITY Daily Debriefing **7**	T.E.A.M. ACT. #3 Pond Clues 11-15 Water Cleanliness Activity Daily Debriefing **8**	T.E.A.M. ACT. #4 Pond Clues 16-20 pH test of Pond Water Activity Daily Debriefing **9**	T.E.A.M. ACT. #5 Pond Clues 21-25 Analysis of all the clues Conclusions groups have reached **10**
Phase 3: (Optional)	You determine the timing of Phase 3. → This UNIT TIME CHART is an example. Alter as desired.			



PHASE 1: DAY 1

Teaching Tip

*When you see an item on the materials list with an M and a number behind it in parentheses (ex: **M1**), look in the **Master** section (beginning on page 39) of the Teacher Guide for the listed item.*

Materials:
1. MY SCIENCE JOURNAL COVER (**M1**)
2. Science journal materials
3. Pencils
4. A person who is familiar to the students
5. A person who is not familiar to the students
6. For the experiment done in the second half hour:
   a. Glass jars (3 of the same size)
   b. Funnels (3 of the same size in plastic or metal)
   c. Coffee filters (6)
   d. Sand (1 cup), potting soil (1 cup), and gravel (1 cup)
   e. Measuring cups (3 one-cup)
   f. Water
7. THE SCIENTIFIC METHOD CHART (**M2**)

Procedure:
1. Before students come to class, do the following things to set up an experiment you will demonstrate later in the day. (*Be sure you do this preparation out of students' sight.)*
   a. Put a funnel in each of the three glass jars.
   b. Place two coffee filters in each funnel.
   c. Pour the sand in one funnel, the potting soil in the second funnel, and the gravel in the third funnel. Set these things aside until you need them during the second half hour of this lesson.

2. As noted in the initial preparation, make arrangements for a person who is familiar to your students but not seen on a daily basis—such as a secretary or a teacher in another grade—to come into your class for a very brief time to talk to you at the very beginning of class. This person should then leave and a second person, who is not familiar to students, should enter the room, speak briefly to you, and then leave.

3. As soon as these "speaking visitors" have left the classroom, pass out the MY SCIENCE JOURNAL cover handout to each student.
   a. Help students make their journals. Use whatever method you desire: the cover glued on top of a folded 17 x 22 inch sheet of colored construction paper … or … a section of a three-ring notebook with their MY SCIENCE JOURNAL cover handout glued and colored on a cover sheet of regular paper.

b. Ask them to record today's date and then write down everything they can remember about the "speaking visitors" who were in your classroom earlier today. In their written descriptions, students should write down every detail about the person they can remember. Tell them they are to describe both of these people in great enough detail that someone who had never seen either of them could clearly picture both persons in his/her mind. Tell your students that they can include a drawing of each person along with their written descriptions if they wish.

Teaching Tip

You may want to chart the descriptions on the board or overhead projector to help students keep track of similarities and differences in the descriptions.

4. After students have completed their descriptions, have them share their descriptions with one another. Point out similarities and differences in the descriptions given by students. If possible, have the two "speaking visitors" who came to your classroom earlier in the day reenter your classroom so that students have the opportunity to compare their descriptions with what the people actually look like.

Read or Tell

5. Read or tell:

"The point of the observation exercise we just did is to help you realize that observations are an important part of a detective's job—even when that detective is a scientist. Scientists make observations regularly. They must carefully write down exactly what they see and conclude in any experiment they do. It is very important to be as accurate as possible so that experiments can be duplicated *exactly* in the future and so that other scientists who read the notes will understand exactly what was observed even if they weren't there. Although you weren't prepared ahead of time, you can see from the observation exercise we did today in class that even though we all looked at the same people, different students in class made different observations of the "speaking visitors." In the next week or so when you will be asked to make scientific observations, you will have advance warning to carefully observe and make notes in your science journal."

6. Students will make use of observation skills as they work on the experiment that you set up earlier.
   a. Bring out the jars and funnels you set up before class.
   b. Pour one cup of water into each funnel.
   c. Have students observe the different amounts of water that seep through into the glass jars.

DAILY DIRECTIONS - 3

Teaching Tip

You may want to assist students as they write notes in their science journals for the first time.

7. Ask students to explain why different amounts of water ended up in the bottom of the jars. Note ideas and suggestions on the overhead or chalkboard. Have students write their thoughts in their science journals.

8. Give each student a SCIENTIFIC METHOD (**M2**) handout. Go over the different steps of the scientific method.

9. Point out that the first step is **The Problem**, which is often written in question form. Explain to the students that *the problem in a science experiment is what you want to find out.* Ask students to think of how they might state the problem for the experiment that was performed in class. Students can work in groups, pairs, or individually to come up with how to phrase the problem. Ask for students to share their ideas and guide them to state the problem *simply*. One example might be: *Why do different amounts of water funnel through different substances?*

10. Next discuss the second step of the scientific method, **The Hypothesis**. Explain that a hypothesis is *an educated guess to answer the question stated in the problem.* A hypothesis does not have to be correct (scientists will tell you they frequently are not correct), but it should be a guess based on things you know and have observed. Have students brainstorm different hypotheses regarding the experiment they just witnessed. Here are some possible ideas:
    a. The amount of material in each funnel varied; the less material in each jar, the more water was able to flow through.
    b. The water was poured faster into some jars than into others, causing more water to funnel through to the jar's bottom.
    c. The materials in each funnel were different sizes; the larger the size of the material, the more water flowed through.

11. If students request information from you regarding how the experiment was set up, share that information with them. Ask students to share their hypotheses with one another and then ask them to note in their science journals the hypothesis they believe to be correct at this time.

12. Tell the students that during tomorrow's class period, they will be learning more about the scientific method and will have the opportunity to see today's experiment conducted once again, to test their hypotheses.

PHASE 1: DAY 2

Materials:
1. Science journals
2. Pencils
3. The following experiment materials:
   a. Glass jars (3 of the same size)
   b. Funnels (3 of the same size in plastic or metal)
   c. Coffee filters (18-24)
   d. Sand (8 cups), potting soil (1 cup), and gravel (1 cup)
   e. Measuring cups (3 one-cup)
   f. Water
   g. Ice
   h. Hot pot (or method to heat water)
   i. Thermometer
4. SCIENTIFIC METHOD (**M2**) handout—passed out previously
5. GRAPHING FORM (**M3**) handout and an overlay transparency

Procedure:
1. Remind students of the experiment you performed yesterday. Before repeating the experiment to test different hypotheses students generated yesterday, read or tell:

Read or Tell

“Before we repeat the experiment we performed yesterday, I want to discuss more information about the scientific method that will help you understand the scientific process. First, remember yesterday that you wrote notes and observations in your science journals. It is very important to keep accurate notes of experiments and observations in your science journals. All scientists do this. Each entry in the science journal is dated and is written in such a way that others could repeat an experiment that the scientist performed. Often scientists will have a witness sign their journals at different times. If a new discovery or invention is made as a result of the experiments, there is a signed record that the scientist can use as proof that s/he was the first to come up with the discovery or invention.”

2. Tell students to refer to the handout, SCIENTIFIC METHOD, given them previously and say:

Read or Tell

"The second thing you need to know before repeating yesterday's experiment is about variables. Variables are all the different factors that can affect the outcome of an experiment. Let's list all of the variables in yesterday's experiment:"

The list should contain the following in any order:
a. Jars
b. Funnels
c. Coffee filters
d. Water amount
e. Water temperature
f. Speed of water being poured into the funnel
g. Time for water to drain
h. Materials in the funnel

Teaching Tip

*You can list these **variables** on the overhead or chalkboard so your students can add the words and their definitions to their science journals.*

3. Explain that **items a-h** above are called **variables**. Continue to explain that whenever you conduct an experiment, all of the variables must be **controlled** except one.

4. Further explain that **controlled variables** are things that you want to keep identical so they do not affect the outcome of the experiment. For example, if your hypothesis says that materials in the containers are different and therefore water flows differently through different-sized material, all of the variables listed above should be the same except for the materials in the funnel (#8).

5. Further explain that the one variable that can be different in an experiment is called the **manipulated variable**. (In the last example, the manipulated variable was the different kinds of materials that were placed in the funnel.)

6. Tell students if their hypothesis was that the temperature of the water made a difference in how much water funnels out of the filters, all of the variables should be controlled (including the kind of material that is put in each filter), except for the temperature of the water. If their hypothesis was that the speed at which the water was poured into the funnel affected how much water filtered through, all the variables in the experiment need to be the same except for how fast the cup of water was poured into the funnel.

7. Point out that for an experiment to be as accurate as possible and for scientists to be able to repeat the experiment more than once to be sure results are valid, the researcher must control all the variables except for the manipulated variable.

Read or **T**ell

8. Read or tell:

    "As we conduct different experiments today, I want you to keep precise notes in your science journals. Remember to note today's date. We will now begin our experiments."

Teaching **T**ip

Depending on the ability of the students in your class, you may need to give an example of how students should take notes on these experiments in their science journals.

9. Have different groups of students come to the front of the room to help test hypotheses that were developed yesterday. The time you need to clean up between each experiment can be used by the students to make notes in their science journals. Since the basic materials and procedures will be nearly the same each time, students should write out materials and procedures once and then just note changes that need to be made in the three successive experiments.
    a. First, change the speed each time water is poured into the funnel—one poured quickly, one medium speed, and one slowly. (Determine exact times before the experiments take place.) Sand should be used in each funnel.
    b. For the second experiment, put exactly the same amount of different materials (sand, potting soil, and gravel) in the funnels.
    c. In the third experiment, change the temperature of the water. Add ice to one cup and heat one cup, remembering to put only one cup of water in the funnels after chilling and heating. The exact temperatures should be noted if possible.
    d. In the last experiment, change the amount of material in each funnel—using sand each time.

Read or **T**ell

10. Discuss the experiment findings with the students. Read or tell:

    "We learned information from doing our experiments in class today. Real scientists repeat experiments many times to be sure results are accurate over time. These results are often charted or graphed to show others who look at the data what information was learned from the experiment. Although a scientist can write out all the data in words, a chart or a graph can often give the same information more clearly and more concisely."

11. Show students how to graph information learned by conducting the four experiments, using the GRAPH FORM (**M3**). Fill out the graph with the class, using the overhead projector or the chalkboard so they understand the process of graphing.

Read or Tell

12. Read or tell students:

 "As scientists repeat experiments over and over, they collect data or information about the experiment. They note any observations, measurements, predictions, and inferences, and from that information they draw conclusions.

 "After yesterday's experiment, you reached inferences *(conclusions based on what you know)* while you were formulating different hypotheses about what caused the level of the water to be different in different jars. Scientists use inferences regularly as they try to determine why something happens as it does. From these inferences, you made a prediction as to which hypothesis was probably correct. The prediction you made was based on your observations, your past experience, or your knowledge about the materials in the experiments."

 "Finally, when scientists have done all of the things I've already mentioned, they develop a conclusion to describe their findings. The **conclusion** is the last part of the scientific method; it is the place where scientists tell what they learned. Scientists arrive at conclusions by carefully looking at their journals, by studying once again the data they collected, and by referring back to their hypothesis. Conclusions must reflect data collected from experiments that they did. What conclusion could we make from the experiments that were done today in class?"

Teaching Tip

It might be a good idea to write down ideas expressed about the conclusion of these experiments on the overhead or chalkboard to assist students who need help writing conclusions.

13. Ask for students to give their input about conclusions that could be made or the possibility that further experimentation would be necessary to get an accurate conclusion.

14. Review all the parts of the scientific method with the class one last time before class ends today.

15. Have students note what they learned today in their science journals.

DAILY DIRECTIONS - 7

PHASE 1: DAY 3

Materials:

1. Science journals
2. Pencils
3. Microscopes (as many as you have for students to share)
4. MICROSCOPE DIAGRAM (**M4:1**) one per student + overlay master
5. MICROSCOPE DIAGRAM KEY (**M4:2**) overlay
6. Salt
7. Sugar
8. 2 slides for each microscope
9. Warm water and dish detergent
10. Paper towels
11. Rubber gloves (optional)
12. Rubbing alcohol

Procedure:

1. Tell your students that today you are going to use microscopes in class. Ask if anyone knows anything about microscopes and have them share what they know with the class. Then say:

Read or Tell

"As you have just heard, a microscope is a tool that scientists use to help see very small things in much greater detail than could be seen with an eye alone. The lens in the microscope magnifies whatever you are looking at so that it appears to be much larger. The microscope is a wonderful tool that is invaluable to many scientists. When it was invented, in the early 1600s, it totally changed the study of science, for scientists were then able to see many things that they could not even imagine before microscopes were invented. The microscope has helped solve many scientific mysteries.

"Before we do activities using the microscope, we need to learn about its components."

2. Give each student a MICROSCOPE DIAGRAM SHEET (**M4:1**).

3. Arrange students around the microscopes and then go over each part so that students will be able to look at the diagram and the actual microscope as they learn its parts.

Teaching Tip

Tell students they should always handle a microscope with care, for it is a ***delicate*** *instrument. If there is ever a reason to move a microscope, one hand should hold the microscope by its carrying arm and the other hand should be under the microscope's base, holding it securely.*

4. Display your MICROSCOPE DIAGRAM KEY (**M4:2**) overlay. Point out each part of the microscope and have students label each part on their MICROSCOPE DIAGRAM SHEETS **(M4:1)**. If any of the following parts are not on your school microscopes, you will want to make note of this fact as your students label their worksheets. Use the following information to help guide you as you discuss the parts of the microscope with your class:
   a. **EYEPIECE**: The eyepiece is that part of the microscope that you look through to see objects in more detail.
   b. **OCULAR TUBE**: A tube leading from the eyepiece to the lenses of the microscope
   c. **CARRYING ARM**: The part of the microscope that is used to lift or carry the microscope. You should use the arm whenever you move a microscope.
   d. **OBJECTIVE LENSES**: The lenses in a microscope that magnify. Some microscopes do not have objectives and are only one power. Microscopes that have objectives can magnify at different strengths.
   e. **STAGE**: To view an object, place it on the stage. Place objects over the hole in the stage.
   f. **STAGE CLIPS**: The stage clips are attached to the stage and hold the slide secure as you are looking through the microscope.
   g. **FOCUS KNOB** or (COARSE AND FINE ADJUSTMENT KNOB): The focus knob moves the stage up and down so that the slide comes into focus for the person looking through the eyepiece.
   h. **MIRROR**: This piece of treated glass reflects light up through and around whatever is being looked at through the eyepiece.
   i. **BASE**: The stand that supports the microscope.

5. To give the students practice using a microscope, have them look at a slide of sugar crystals and a slide of salt crystals under the microscope. At first do not tell them what they are seeing. Ask students to record their observations in their science journals both in writing and by drawing what they see. *(Check once again to ensure that they are dating their science journals.)*

6. Show your students how to clean slides that have been used. Slides (and cover slips) can be cleaned in warm water which contains some dish detergent. When slides are being placed in the water and taken out of the water, they should be handled by their sides and, if available, the persons cleaning the slides will be better protected if they wear rubber gloves. Tell students that they should be very careful when cleaning slides because the edges could be sharp. Slides should be dried standing up on an angle (leaning against a clean jar) on a dry paper towel.

To sterilize slides, soak them in rubbing alcohol and once again dry them standing up on an angle on a dry paper towel. Slides should be completely dry before they are stored.

7. To end this session, have students write a short description in their science journals about what they learned today about microscopes.

PHASE 1 DAY 4

Materials:
1. Science journals
2. Pencils
3. Microscopes
4. 4 slides for each microscope
5. Cover slips (or scotch tape) for slides
6. Various things to look at under the microscope: onion skin, leaf, small seeds, water droplet, a piece of hair, a clipping from a newspaper or a magazine, a thin, small piece of potato, etc.
7. A box of toothpicks
8. **Optional**: iodine stain or blue stain to drop on specimens being observed to help better define the cells. ***Note**: This stain should be handled only by the teacher.*

Teaching Tip

Patience is required as you introduce microscope skills, but it is worth it. Students' excitement will excite you. ***Discovery "will light their fire."***

Procedure:
1. Show students how to prepare a slide to observe something "using" the microscope. Tell students that whenever you observe something using a microscope, *you must begin with a clean slide*. Demonstrate that students should be careful not to touch the middle of the slide because they can leave fingerprints on the slide.

2. Help students understand that the item placed on the slide should be very thin. Demonstrating with an onion skin will help students understand the concept. Show students how to take a small portion of onion skin (the part of the onion that is between the layers of an onion), place it carefully on the middle of a slide with a toothpick.

3. If cover slips are available for slides, use them and go on to step #4. If not, students can be taught how to make cover slips using scotch tape. This is a technique you may want to teach students even if cover slips are available because cover slips may not always be available.

Scotch tape cover slips:

a. Cut off a length of scotch tape that measures between 1 and 1/2 and 2 inches.
b. Hold the tape by its ends only (do not touch the center of the tape since you will leave a fingerprint on the tape)
c. Holding both ends of the tape, lower it slowly to the object that you wish to look at under the microscope and touch it gently with the tape so that it sticks.
d. Attach your tape to a slide, pushing the ends down first.

4. Demonstrate to students how to set up a wet mount slide with the onion skin slide you made in #2 above. Read or tell students the following—and *demonstrate* as you are talking:

Read or Tell

"A wet mount slide is a slide that is wet with either water or a stain. The way to make a wet mount slide is to add a drop of liquid—either water or dye—to the object on the slide. Then hold the cover slip at an angle, letting it slowly drop to the slide. Avoid creating air bubbles between the slide and cover slip because these bubbles show up as dark circles when you look through the microscope. Once you have made a wet slide without any air bubbles, you are ready to look at it through the microscope."

Teaching Tip

If iodine or blue stain is available, you can add a drop of stain to any of the slides mentioned here.

5. Set up various microscope stations in your room for your students, and create a variety of slides. Depending on how many microscopes are available for students, you will want to create at least five different stations:
   a. Look at a small piece of onion skin
   b. Create a scotch tape cover slip and look at a small thin piece of a potato.
   c. Have students look at a small leaf.
   d. Have students look at a piece of their own hair under the microscope. Ask them to compare their hair with another student's hair in their group—a hair that is a different color or texture.
   e. Using a picture from a newspaper or magazine—or if you have enough microscopes, both—have students look at these samples under the microscope.

6. Be sure students draw and describe in their science journals what they see at each station. Comparisons between the stations should be made, and if any generalizations can be made, students should try to make them (e.g., plant vs. animal).

DAILY DIRECTIONS - 11

7. Ask students (or groups) to share their findings at the end of this session to help conclude the microscope activities of the past two days.

PHASE 1: DAY 5

Materials:
1. Science journals
2. Pencils
3. Red, orange, and yellow crayons, one set per group
4. Paper towels
5. Beakers or small containers like baby food jars
6. Litmus test tabs
7. Color pH test strip indicators
8. Different things to test for pH: tap water, milk, cola or soda pop, orange juice, lemons, grapefruit, apple juice, vinegar, liquid soap, shampoo, cream rinse, eggs, household cleaning products

> **Teaching Tip**
>
> *Litmus test tabs or pH paper can usually be found in teacher supply stores. Be sure that any substance to be tested is safe for students to handle. Extremely strong acids or bases such as bleach (e.g.,* ***Clorox****) or drain cleaners can burn.* ***They should absolutely not be used for experimental purposes.***

Procedure:
1. Ask students if they know what **pH** is. Teach them that pH is the symbol which represents the amount of acidity (acid) or alkalinity (base) contained in a substance. *Draw this pH scale on the board:*

|—|—|—|—|—|—|—|—|—|—|—|—|—|—|

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Acid **Neutral** **Base**

On this type of pH scale, a pH reading of 1 is a stronger acid than a pH reading of 5. Likewise, a pH reading of 13 is a stronger base than a pH reading of 8. A pH reading of 7 is neutral—neither an acid or a base.

2. Have students draw this chart in their science journals. Then tell them to color 0 to 4 (**Acid**) red; 5 to 8 (**Neutral**) orange; and 9 to 14 (**Base**), yellow.

3. At this time it is very important to discuss with students the dangers of very strong acids and very strong bases. *Students need to be made aware of the fact that acids with very low readings and bases with very high readings are dangerous and can burn.* pH should be tested only with adult supervision and should only be of substances that students are normally allowed to touch.

4. Have students look at the color test strip indicators and compare them to the pH scale on the board. Usually color strip indicators show yellow for acids and red for bases; neutral substances are usually orange. These color strip indicators will help them determine whether the substance they are testing is an acid, a base, or neutral.

5. Before students actually test any of the substances, have them make predictions indicating whether a substance is an acid, a base, or neutral. They should also predict which of the substances they test will be the strongest acid or base. Also ask them to rank the substances in their science journals from the strongest acid, to neutral, to the strongest base. This ranking will constitute the hypothesis for today's activities.

Teaching Tip

Note: Students within each group can have different hypotheses.

6. Divide the students into groups of four or five students.

7. Have each group test each substance and carefully record their results in their science journals, using written descriptions, illustrations, or both.

8. When groups report their findings to the rest of the class, have them take turns. For example, if group 1 reports what it found for tap water, group 2 can report what it found for milk, group 3 can report what it found for cola, etc. After each group reports its findings, ask other groups in the room if they had similar findings.

9. Results can be graphed and displayed if you desire to do so.

PHASE 2: DAY 1

Materials:
1. Science journals
2. Pencils
3. Student Guides
4. POND CLUES #1-5 (**M5:1**) cut into strips (one set for each group of students)
5. One large sheet of construction paper for each group to make a group folder
6. Stapler
7. T.E.A.M. ACTIVITY #1 (**M6:1 & M6:2**) cut into strips
8. T.E.A.M. ACTIVITY #1 RECORDING sheet (**M7**)
9. DETECTIVE REPORT FORM (**M8**) handout and overlay master
10. Microscopes—at least one for every group of six students, if possible

11. A half cup sample of pond water kept in a jar with a lid (If pond water is not available, use water from an established freshwater fish tank.)
12. A slide and cover slip for each microscope
13. An eyedropper
14. A blank transparency for the overhead projector

Procedure:

1. Pass out the STUDENT GUIDES. Tell students to read the introductory news articles (pages 1-2) and then the letter from Richard Peterson on page 3.

Read or Tell

2. Read or tell:

   "Mr. Peterson has contacted your class because he heard that you are hard working scientific detectives.

   "To help us be better informed about ponds so that we can help Mr. Peterson, we will start each day with a group problem-solving activity. Please open your Student Guides to page 7 and read about the T.E.A.M. ACTIVITIES you will be doing daily with your group members."

3. After students read this page, ask if they have any questions. Be sure to emphasize that each member of the group is to participate in the activity. Ask the class to give ideas about how a group member who is shy might be helped to participate in the group activity.

Read or Tell

4. Read or tell:

   "As we learn about ponds, I will record the information we learn on an overhead transparency. I will add information to this transparency every day to keep track of what we are learning. You will be noting the same information in your science journals."

5. Divide your class into groups of 5-6 students each. The groups that you establish will remain together for the duration of Phase 2.

6. Pass out the large sheet of construction paper to each group and tell them they will use this paper to make a group folder. This folder is where important group information will be stored.

7. Pass out T.E.A.M. ACTIVITY #1 STRIPS, giving each team member a different strip. Pass out one T.E.A.M. ACTIVITY #1 RECORDING SHEET to each group. Tell students that the objective of this activity is to determine where creatures of the pond live: on the edge of the pond, in the middle of the pond, or on the bottom of the pond. Tell each group to record answers on their recording sheets as each member reports.

8. When groups have finished the activity, ask where each creature was placed on the recording sheet and have students justify this placement using the information that was given to them. Using the key below, have students grade their own sheets, correcting them if necessary. Tell each group of students to store this activity in their team folder.

   T.E.A.M. ACTIVITY #1 answer key: **Edge of Pond:** frogs, turtles, beavers, and ducks; **Middle of Pond:** frog eggs and tadpoles, goldfish, worms, and ducks; and **Bottom of Pond:** snails, catfish, clams, and crayfish.

Teaching Tip

Tell students that Mr. Peterson told you he will be sending clues along each day that may help them solve the mystery at Peterson's Pond.

9. Pass out POND CLUES #1-5 to each group. Have students in each group examine these clues together.

10. Tell students that to better understand the pond environment, it will be helpful to examine pond water under a microscope. Give each group a microscope, a slide, and a slide cover.

11. Read or tell:

Read or Tell

> "Mr. Peterson sent over a sample of his pond water for us to examine. Today we will all look at the pond water and record the microscopic things we see in our science journals. All group members will need to take a turn looking through the microscope and recording what they see. Members of the group who are not looking through the microscope should get out their science journals and document information that was learned during T.E.A.M. ACTIVITY #1 and from POND CLUES 1-5."

12. Using the dropper, give each group a drop of "pond" water on its slide and have members place a slide cover on top of the drop. Team members should take turns examining the water sample and diagramming what they see in their science journals.

Teaching **T**ip

This form may be useful at other times during this simulation when students are asked to use the scientific method.

13. Pass out a SCIENTIFIC DETECTIVE REPORT FORM (**M8**) to each student. Tell students that you are going to be keeping the sample of pond water throughout this week. Each day, you will put a drop of the pond water on a slide and one microscope in the room will be available for students to examine the drop each day. Using the scientific method, write the question, "What will happen to a pond water sample that is kept at room temperature for five days?" Then ask the students for some predictions (hypotheses) as to what will happen to the pond water sample and record the information on a SCIENTIFIC DETECTIVE RECORD FORM overlay. Ask the students to record the information you are writing on the overhead on their own SCIENTIFIC DETECTIVE REPORT FORMS.

14. Put a blank transparency on the overhead.
    a. Tell students that each day there will be a short debriefing session on what they have learned.
    b. Ask students, "What have we learned today?"
    c. Briefly note on the overlay ideas students share. One way to keep track of progress over time is to use a different color overhead pen each day to record information. At the top corner of the transparency, write the date in the color pen you are using that day.
    d. Students should be encouraged to add notes to their science journals as a result of this daily discussion.

15. Have students clean up for the day.

PHASE 2: DAY 2

Materials:
1. Science journals
2. Pencils
3. POND CLUES #6-10 (**M5:1**) cut into strips (one set for each group of students)
4. T.E.A.M. ACTIVITY #2 cut into strips (**M9:1** & **M9:2**)
5. T.E.A.M. ACTIVITY #2 RECORDING SHEET (**M10**)
6. Student Guides
7. 200 cotton swabs (or enough for each student in the class to have four swabs)
8. Clear cups or baby food jars with lids (24)
9. Masking tape
10. Permanent marker
11. Drinking water
12. Sugar
13. White vinegar

Teaching Tip

If baby food jars with lids are used, plastic wrap and rubber bands are not needed.

14. Salt
15. Plastic wrap
16. Rubber bands
17. Microscope set up with a new pond sample slide
18. Transparency used for the debriefing notes from yesterday

Procedure:

1. Before class, set up in the following way: Each group will need four cups. Put a small piece of masking tape on each of the cups for all the groups. Each of the cups should be filled about 1/2 full. One of the cups should contain drinking water (label this cup *A* with the permanent marker). The second cup should contain drinking water with 2 tablespoons of sugar dissolved in it (label this cup *B* with the permanent marker). The third cup should contain drinking water with 1 tablespoon of salt dissolved in it (label this cup *C* with the permanent marker). The fourth cup should contain white vinegar (label this cup *D* with the permanent marker). Secure plastic wrap around the top of each cup with a rubber band.

2. Set up a new slide with a drop of pond water from yesterday's pond water sample for students to examine under the microscope.

3. Here is **an update from the pond**: Read or tell the following information to the class:

Read or Tell

"Mr. Peterson was interested to hear about your microscopic observations since he doesn't have a microscope. He doesn't believe that the water in the pond is polluted because it doesn't look discolored. However, he continues to find dead fish, frogs, and other creatures in and around the pond. He sent over the next set of POND CLUES for you to examine."

4. Pass out POND CLUES 6-10 to each group of students and allow each group time to read the clues.

5. Pass out T.E.A.M. ACTIVITY #2 STRIPS and one T.E.A.M. ACTIVITY #2 RECORDING SHEET to each group. Tell students the objective of this activity is to determine where plants in the pond grow: the emergent zone, the floating leaf zone, or the submergent zone. As a result of doing this activity, students will also be able to define these terms. Tell groups to record answers on their recording sheets.

6. When groups have finished the activity, discuss the three different plant zones in the pond along with where each of the plants in the activity should be located. This information, along with the information gained from T.E.A.M. ACTIVITY #1 yesterday, will give your students information about plants and animals in and around the pond. Use the key below to correct any errors the groups might have made.

   T.E.A.M. ACTIVITY #2 answer key: **Emergent Zone**: algae, cattail, ferns, cattail; **Floating Leaf Zone**: algae, water hyacinth, water lilies, wild celery; **Submergent Zone**: algae, coontail, bladderwort, elodea, pond weed; **Other:** duckweed.

7. Tell the students that to test Mr. Peterson's belief that the pond water probably isn't polluted because it doesn't look discolored, they are going to do an activity to determine whether pollution can be determined by just looking at the water.

8. Hold up a cup *A*, cup *B*, cup *C*, and cup *D* and have students determine whether the liquid in each cup looks polluted.

Read or Tell

9. Read or tell students:

   "The activity we are going to do today will help us determine whether you can tell what is contained in water just by looking at it. We will look at each cup, smell the contents, and then taste it with a cotton swab to see whether all of the cups contain the same thing. On your own, you should never taste an unfamiliar substance because it could be dangerous, but for the purposes of this activity, I will assure you that each of these substances is safe to taste.

   "There is also an appropriate way to smell a substance if you don't know what the substance is. Do not stick your head directly into the cup, but keep the cup at least 6 inches from your face and move the air over the cup with your hand so that you can smell it. Using this method to smell an unknown substance is the safest way to smell because it will not give as strong a scent as smelling directly over the cup.

Teaching Tip

Emphasize the importance of never tasting an unknown substance or smelling an unknown substance too closely.

"To taste each substance, you will each get four cotton swabs and you will use a new cotton swab for each substance. Throw away each cotton swab you use as soon as you have tasted it so that it will not touch any of your clean cotton swabs and so that you will not get confused as to which swabs are clean and which are used."

10. Hand out a set of cups to each group and four cotton swabs to each student.
    a. Have students carefully take the plastic wrap off each cup and tell them to smell the contents of each cup. (Monitor the smelling process you described above.)
    b. Pass the cup to each member of the group, allow them to smell the contents, and record the experience in their science journals.
    c. They should then taste the contents of each cup in order, using a new cotton swab each time and recording each taste in their science journals.

11. When students have completed this activity, review what they learned and disclose what they were actually tasting.
    a. Elicit from the class the point of this activity: ***You can't always determine pollution by looking at the clarity of the water.***
    b. Point out to students that they should never drink water from a pond or lake even if the water looks clear because pollutants and hazardous substances cannot always be seen.

12. Tell students to open their Student Guides to pages 4-5 and ask them to examine the map of the area around Peterson's Pond. Tell them that they may wish to refer to this map as they receive new clues. Studying the map could help them determine what might be causing the deaths of the creatures in and around Peterson's Pond.

13. Have students add to their science journals information learned from today's T.E.A.M. ACTIVITY, the POND CLUES, and the pollution exercise. Ask if anyone looked at the microscopic pond water sample. Ask them to compare today's and yesterday's samples.

Teaching Tip

Remember to use a second color overhead projector pen to note new information on the overhead transparency.

14. Put the transparency on the overhead projector and ask students to share information they learned today for the scientific debriefing period. Record information shared on the transparency.

15. Have students clean up for the day, storing T.E.A.M. ACTIVITY #2 and POND CLUES 6-10 in their team folders.

PHASE 2: DAY 3

Materials:

1. Science journals
2. Pencils
3. POND CLUES #11-15 (**M5:1**) cut into strips (one set for each group of students
4. T.E.A.M. ACTIVITY #3 cut into strips (**M11:1** & **M11:2**)
5. T.E.A.M. ACTIVITY #3 RECORDING SHEET (**M12**)
6. Student Guides
7. Coffee filters (one for each group)
8. Clean jars (e.g., baby food jars, one for each group)
9. Rubber bands
10. Eyedropper
11. Wax paper
12. Magnifying glasses (at least one for each group of students)
13. Half cup sample of pond water kept in jar with a lid (again, if pond water is not available, use water from an established freshwater tank. The same pond water sample from day 1 can be used)
14. Microscope set up with a new pond sample slide
15. Transparency used for the debriefing notes from the previous two days

Procedure:

1. Before class, set up in the following way: Each group will need one clean jar, a coffee filter, a rubber band, a sheet of wax paper about 12" x 12", and a magnifying glass. Also, set up a new slide with a drop of pond water for students to examine under the microscope.

Read or Tell

2. Read or tell the class:

   "The activity we will be doing today is an additional test on the clarity of the pond water. We will begin this activity before we do our T.E.A.M. ACTIVITY, but will complete it after we finish the T.E.A.M. ACTIVITY for the day."

Read or Tell

3. UPDATE FROM THE POND: Read or tell the following information to your class:

   "Mr. Peterson was glad to receive our report on yesterday's activities. He is still not totally convinced that the water in his pond is polluted and would like further information about the cleanliness of the water in his pond. He sent over POND CLUES 11-15 for you to examine."

4. Tell the class that they will be testing the cleanliness of the pond water by filtering the water through a coffee filter and later examining the filter with a magnifying glass. Ask each group to come up with a question that would fit this activity along with a hypothesis of what group members believe they will find.

5. Inform the class that after the materials are handed out, one person will need to secure the coffee filter to the top of the jar using a rubber band, and must then place the jar on top of the wax paper (in case some water drips). Then you will come around to each group and will put a few droppers full of Peterson's Pond water on top of the coffee filter. Tell the students that once they finish with this portion of the activity, they will set it to the side and work on T.E.A.M. ACTIVITY #3.

Teaching **T**ip

Put enough water on the filters to make them wet, not soaked, because you will want them to dry a bit before students examine them with the magnifying glasses.

6. Pass out the materials and go around to each group, putting 3 to 4 eye droppers full of pond water on their coffee filters.

7. Pass out T.E.A.M. ACTIVITY #3 STRIPS and one T.E.A.M. ACTIVITY #3 RECORDING SHEET to each group. Tell students the objective of this activity is to determine if the creatures in the pond are omnivores, herbivores, or carnivores. As a result of doing this activity, students will also be able to define these terms. Tell groups to record answers on their recording sheets.

8. When groups have finished the activity, have students discuss if each creature listed is a herbivore, carnivore, or omnivore along with the definition of each of these terms.
   Use this key to correct any errors:
   T.E.A.M. ACTIVITY #3 answer key: Omnivores: wrigglers, worms, tadpoles, salamanders, ducks, perch, turtles. **Herbivores**: carp, snails, goldfish, beavers, pill clam. **Carnivores**: crayfish, frogs, snakes.

9. Students should now use the magnifying glass to examine the coffee filter, looking for any discoloration. They should record any findings in their science journals. Since students have to take turns examining the filter, they should use spare time to add to their science journals the information they learned today from both the T.E.A.M. ACTIVITY and the POND CLUES.

Remind students that they can use their science journals to sketch what they see under the magnifying glass and under the microscope.

10. Have students share their findings with the rest of the class. Record any new information learned today on the pond debriefing transparency (along with the notes for the past two days). Ask for students who had the opportunity to look at the microscopic sample of pond water today to report what it looked like compared to yesterday and the day before. Have students note this information in their science journals.

11. Have students clean up for the day, placing the T.E.A.M. ACTIVITY results and new POND CLUES in their group folders.

PHASE 2: DAY 4

Materials:
1. Science journals
2. Pencils
3. POND CLUES #16-20 (**M5:2**) cut into strips (one set for each group of students)
4. T.E.A.M. ACTIVITY #4 cut into strips (**M13:1** & **M13:2**)
5. T.E.A.M. ACTIVITY #4 RECORDING SHEET (**M14**)
6. Student Guides
7. Paper towels (2 per group)
8. Small containers with lids (like baby food jars—2 for each group)
9. Masking tape
10. Permanent marking pen
11. Litmus test tabs or pH paper (1 for each student in the class)
12. Color coded pH charts *(See **Phase 1: Day 5–Procedure** if you want students to make these, assuming they have not done so already.)*
13. Tap water
14. Baking soda
15. Eye droppers (two for each group of students)
16. Microscope set up with a new pond sample slide
17. Pond debriefing transparency

Teaching Tip

Color coding aids learning.

Procedure:
1. Before class, set up the following: Each group will need 2 baby food jars (or similar containers) each having a strip of masking tape on the side.
   a. One jar should be filled half-way with tap water and labeled "Paulson's Pond sample"; the other jar should be filled half-way with tap water plus two tablespoons of baking soda, and labeled "Peterson's Pond sample."
   b. Each group also needs one pH test strip for **each** student in the group, a color coded pH chart, two eye droppers, and two paper towels.
   c. Also set up a new slide with a drop of pond water for students to examine under the microscope.

2. **Update from the pond**: Read the following information to your class:

Read or Tell

"Mr. Peterson appreciated the information from the test you did yesterday to further determine the clarity of the water in his pond. He still feels that something is wrong with the pond water, and he would like us to continue working to find out if his feeling is true. To help you with this activity, he sent over another sample of water from his pond as well as a sample of water from his neighbor Mr. Paulson's pond. His pond water seems to be very healthy so that you can compare the two pond samples. Of course, he also sent POND CLUES #16-20 for you to examine today."

3. Pass out T.E.A.M. ACTIVITY #4 strips and T.E.A.M. ACTIVITY #4 RECORDING SHEET to each group of students. Tell students the objective of this activity is to determine if the creatures in the pond are vertebrates or invertebrates. As a result of doing this activity, students will also be able to define these terms. Tell groups to record answers on their recording sheets.

4. When groups have finished the activity, discuss if each creature listed is a vertebrate or invertebrate along with the definition of these terms. Use the following key to correct any errors.

   T.E.A.M. ACTIVITY #4 answer key: Vertebrates: goldfish, frog, beavers, turtles, salamanders, newts, catfish, ducks, snakes; **Invertebrates:** snails, crayfish, mosquito larvae, protozoan, worms, mosquitoes, pill clam.

5. Tell the students that to test Mr. Peterson's hypothesis that there is something wrong with his pond water, they are going to do an activity to test the health of the water in Mr. Peterson's pond compared with his neighbor Mr. Paulson's pond water.

Read or Tell

"One way to help determine the health of water is a pH test. Testing the water's pH will determine whether the water is acidic, basic, or neutral. Healthy pond water would be in the neutral range."

Teaching Tip

This explanation may be a repeat from Phase 1.

6. Show students the pH scale and explain that the scale ranges from **0** to **14** ... and that ... **0** to **6.9** is **acidic** ... and that ... **7** is **neutral** ... and that ... **7.1** to **14** is **alkaline (basic)**. The closer to 7 a substance tests, the weaker the acid or base.

7. Explain how students will test the pH of the pond samples. Tell them they will each get a sample of water from Peterson's Pond as well as a sample of water from Paulson's Pond. Each group will be given 2 eye droppers: one that should be used only in the Peterson's Pond sample; the other should be used only in the Paulson's Pond sample.

*Point out that **repeated experimentation is an important part of the scientific method.***

8. Since each student in the group was given a pH test strip, they will be able to repeat the experiment to see if results stay the same.
   a. Half the students in each group will test the Peterson's Pond sample; the other half will test the Paulson's Pond sample.
   b. Tell students to be sure that a paper towel is under each sample of water they are testing.
   c. They should then place one drop of water from the sample they are testing on their own pH test strip and determine the pH of the water they are testing.
   d. Finally, tell students that they should record their pH test findings in their science journals.

9. Have groups share their findings with the rest of the class and record any new information learned today on the Pond Debriefing overlay. Remind students that they should be recording thoughts and possible solutions to the Peterson's Pond problem in their science journals.

10. Ask if any student had the opportunity to look at the microscopic sample of pond water today and what it looked like compared to what it looked like on previous days. Have students note this information in their science journals.

11. Have students clean up for the day, placing T.E.A.M. ACTIVITY #4 and POND CLUES #16-20 in their group folders.

PHASE 2: DAY 5

Materials:
1. Science journals
2. Pencils
3. T.E.A.M. ACTIVITY #5 (**M15:1** & **M15:2**) cut into strips (one set for each group of students)

4. T.E.A.M. ACTIVITY #5 RECORDING SHEET (**M16**)
5. Student Guides
6. POND CLUES #21-25 (**M5:2**) cut into strips (one set for each group of students) Students should use all 25 POND CLUES today.
7. Microscope set up with the new pond sample slide
8. A blank overhead transparency

Procedure:

1. Tell the class that with all of the information they have gathered (including today's information), they should be able to solve the pond mystery by the end of class.

Read or Tell

2. **Update from the pond**: Read or tell your class:

"Mr. Peterson was very interested to learn the results of your pH testing of his pond water compared to Mr. Paulson's pond water. Since the pH in his pond was not in the normal range, it is likely that you have found out some important information about why the creatures in his pond are dying."

3. Pass out T.E.A.M. ACTIVITY #5 STRIPS and one T.E.A.M. ACTIVITY #5 RECORDING SHEET to each group of students.
   a. Tell students the objective of this activity is to create a food web of the pond.
   b. Since there are a number of possibilities for correct answers to this activity, if groups can justify their answers based on the information given, accept their answers.
   c. Tell groups to record their answers on their recording sheets.
   d. When groups have finished the activity, each team should share the food web they created with the rest of the class.

4. Before passing out POND CLUES 21-25, ask each group to get out POND CLUES 1-20.
   a. Explain to students that with all of these clues, the mystery about why the creatures near Peterson's Pond are dying is solvable.
   b. Tell students that after they analyze and sort the clues, they are to write in their science journals a conclusion about what they believe is causing the creatures to die at Peterson's Pond.

Teaching Tip

Members of each group may discuss the possibilities, but each member is to make up his/her own mind and record this opinion in their own journals.

5. After giving students time to analyze clues and write in their science journals, ask groups to share what they have concluded about the mystery.

Teaching Tip

Writing the class letter provides assistance to those students who need help summarizing. The letter can be shared with the principal to demonstrate the learning that has taken place as a result of participating in this simulation.

6. Once the class has come to a consensus, tell them that together they will write a class letter to Richard Peterson explaining the answer to the mystery.
   a. Write the group letter on the blank transparency.
   b. If students have computers or word processors available, ask them to compose their own letters at a later time. Otherwise, the group letter can be copied over by a student or word processed by the teacher.

7. If you are planning to use the Challenge Projects in Phase 3, have students examine these possibilities on page 8 of their Student Guides. If you are not planning to have students do Phase 3, you may want to ask your students to write a brief essay about what they learned from doing this simulation. This essay will provide a way for you to determine the learning that took place and will also provide your students with a sense of closure and accomplishment.

PHASE 3: GOING FURTHER OPTION

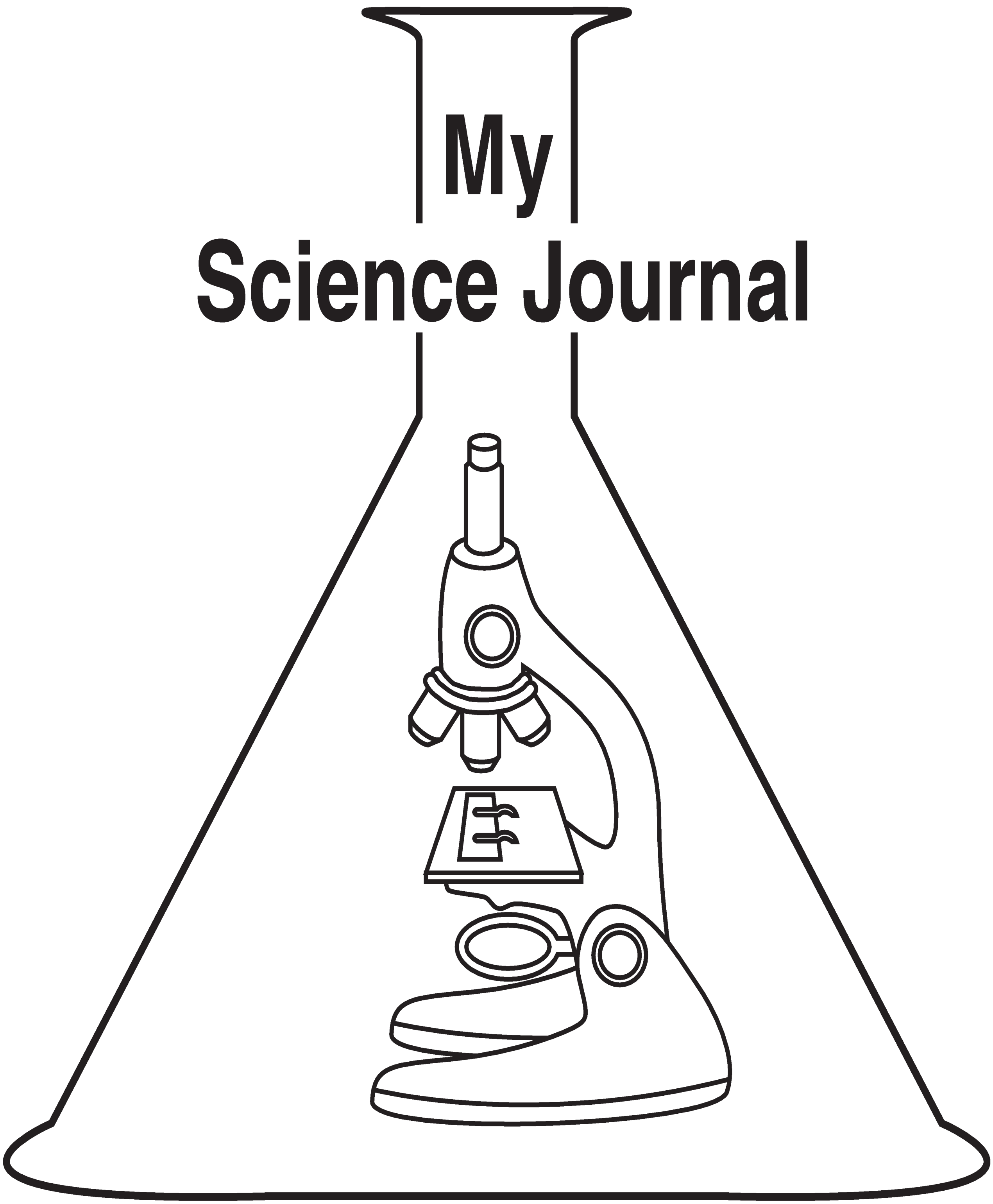
1. Study carefully page 8 of the Student Guide to see samples of **"going further options"** you might wish to have your students do.

2. Realize that Phase 3 is an *optional* portion of this simulation. If you choose not to do this phase, you should still make students aware that real scientists in this field would not just stop after finding the results in Phase 2. Environmental scientists would either find a way to share their findings or do further investigations about the topic or in a related field.

3. If you feel the whole class does not have time to do Phase 3, an option is to offer Phase 3 to students who are interested or who would welcome an additional challenge.

4. If you do decide to do Phase 3, you are free to add your own ideas and students' ideas to the list on page 8 of the Student Guide. Realize the possibility that students themselves might generate **"going further options"** that would most interest them.

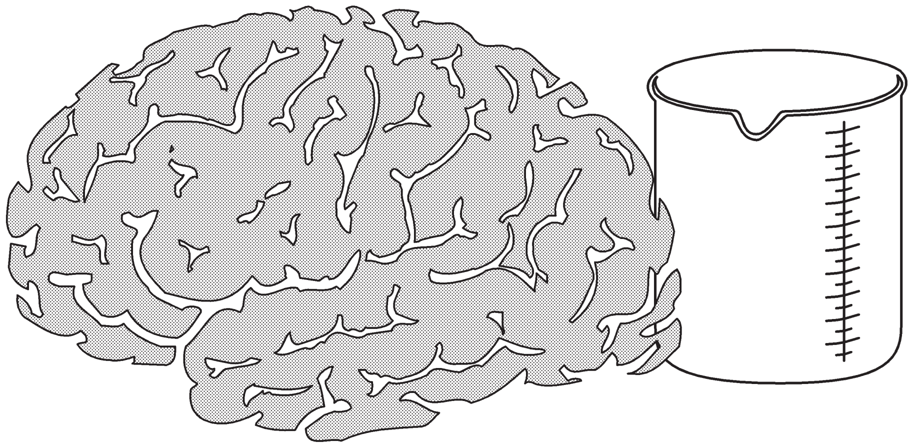
My
Science Journal



Name: ______________________________

The Scientific Method

Using your brain in sequential steps



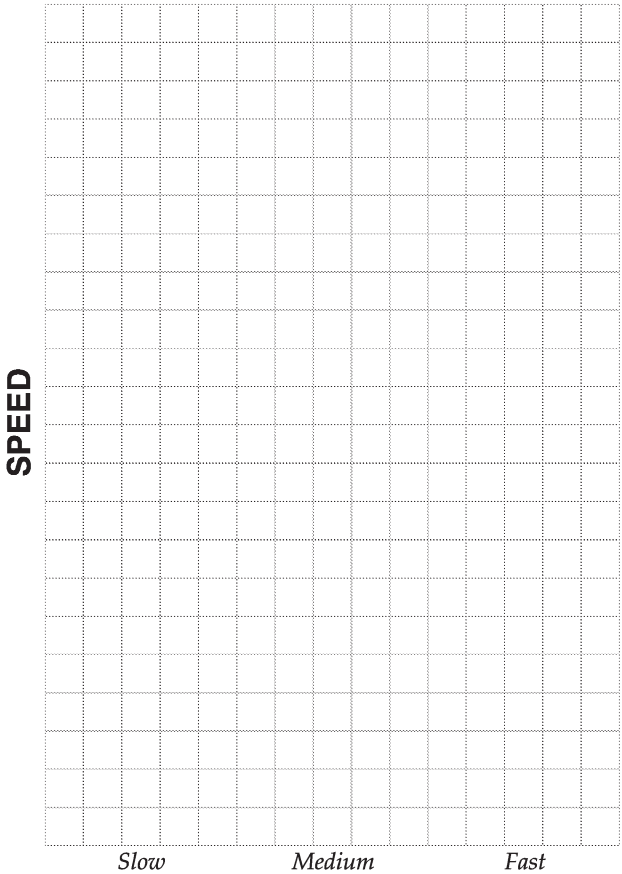
1 **Problem:** What do you wish to find out?

2 **Hypothesis:** What do you think the answer is?

3 **Experiment:** Design a procedure (experiment) to test your hypothesis.

4 **Data:** Conduct the experiment and keep accurate records of your results. Repeat the experiment a number of times. Record the information you collect (data) in a science journal. (You may also wish to put some information on a graph.)

5 **Conclusion:** Summarize what you have discovered (concluded) as a result of doing this experiment.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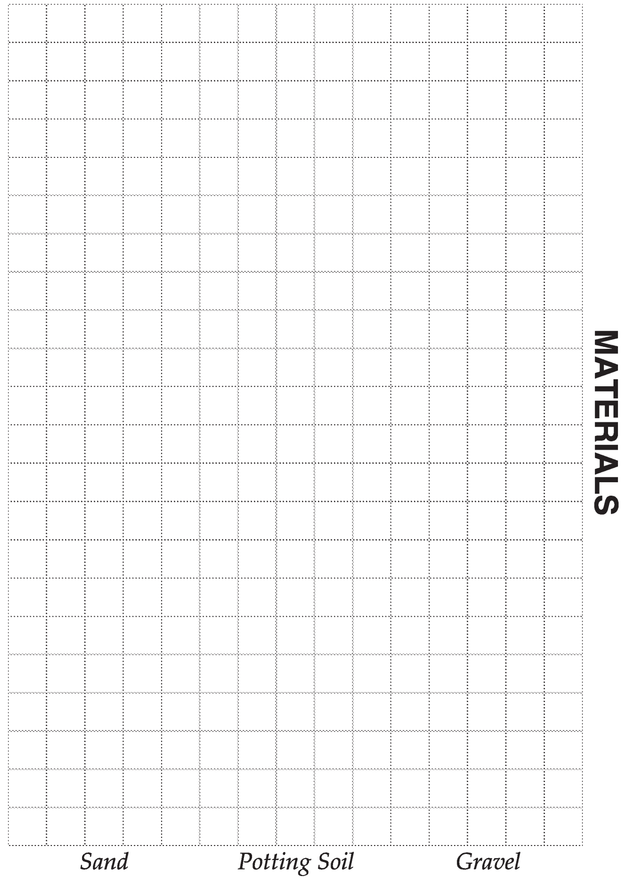
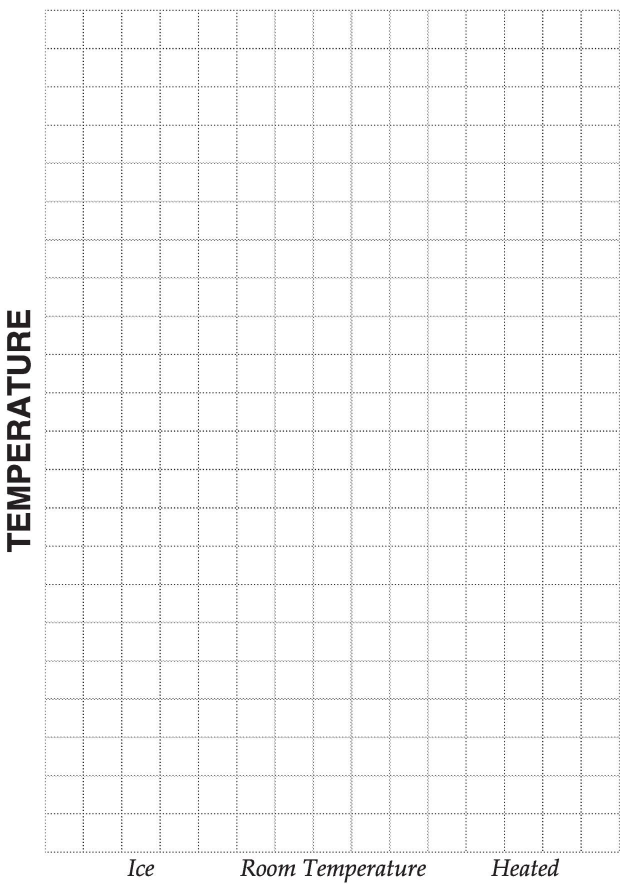
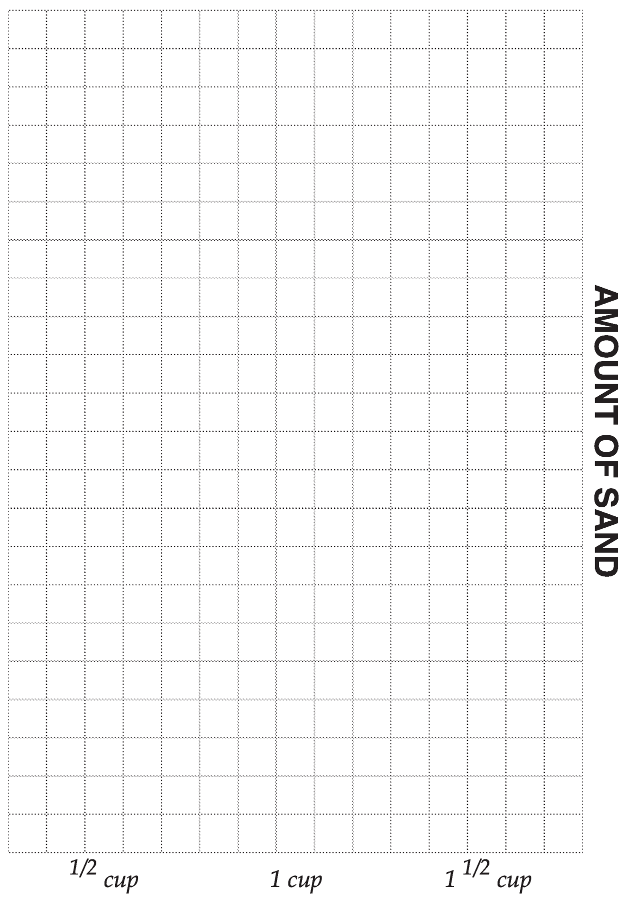
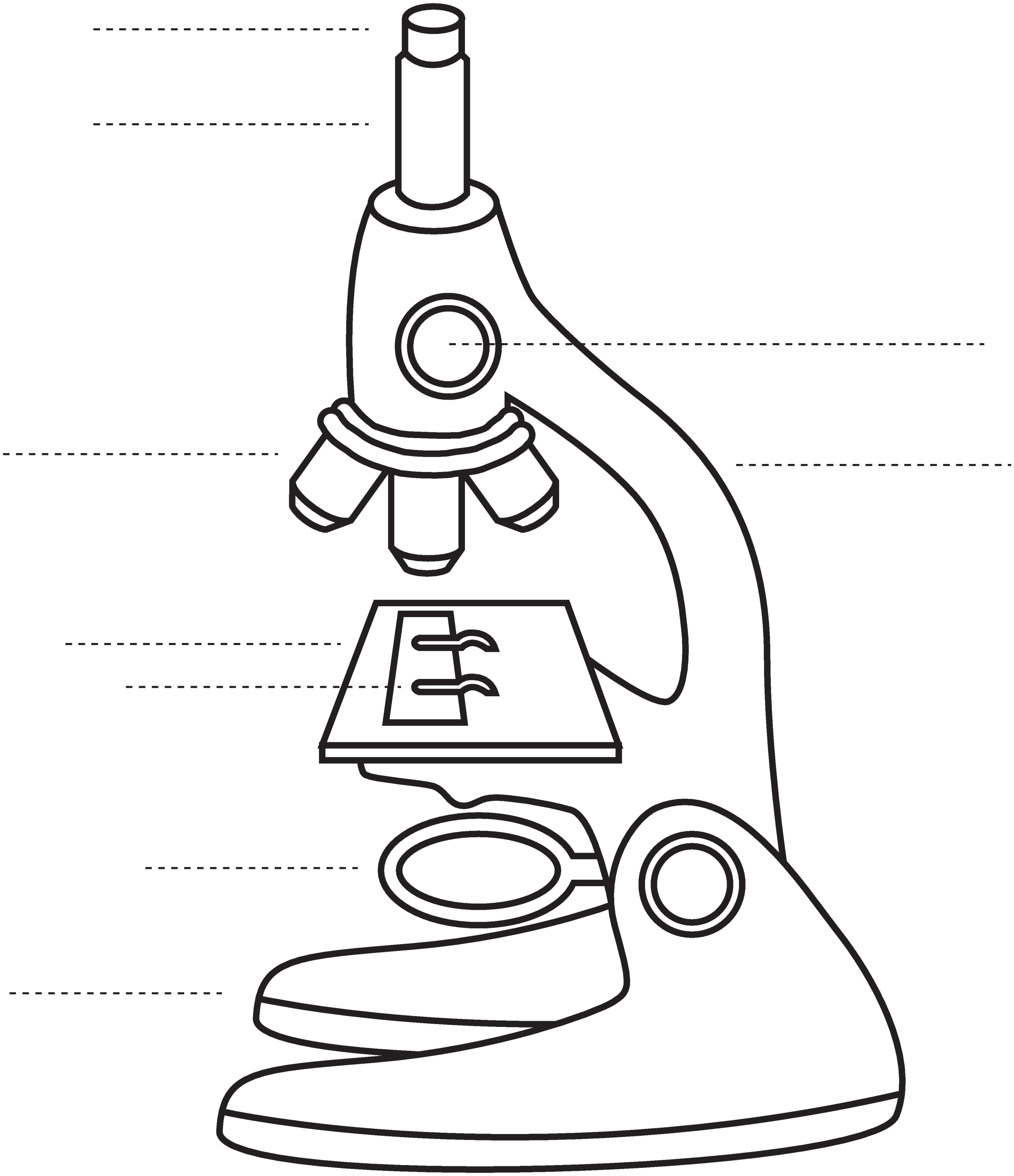
Slow
Medium
Fast


MATERIALS
Sand
Potting Soil
Gravel

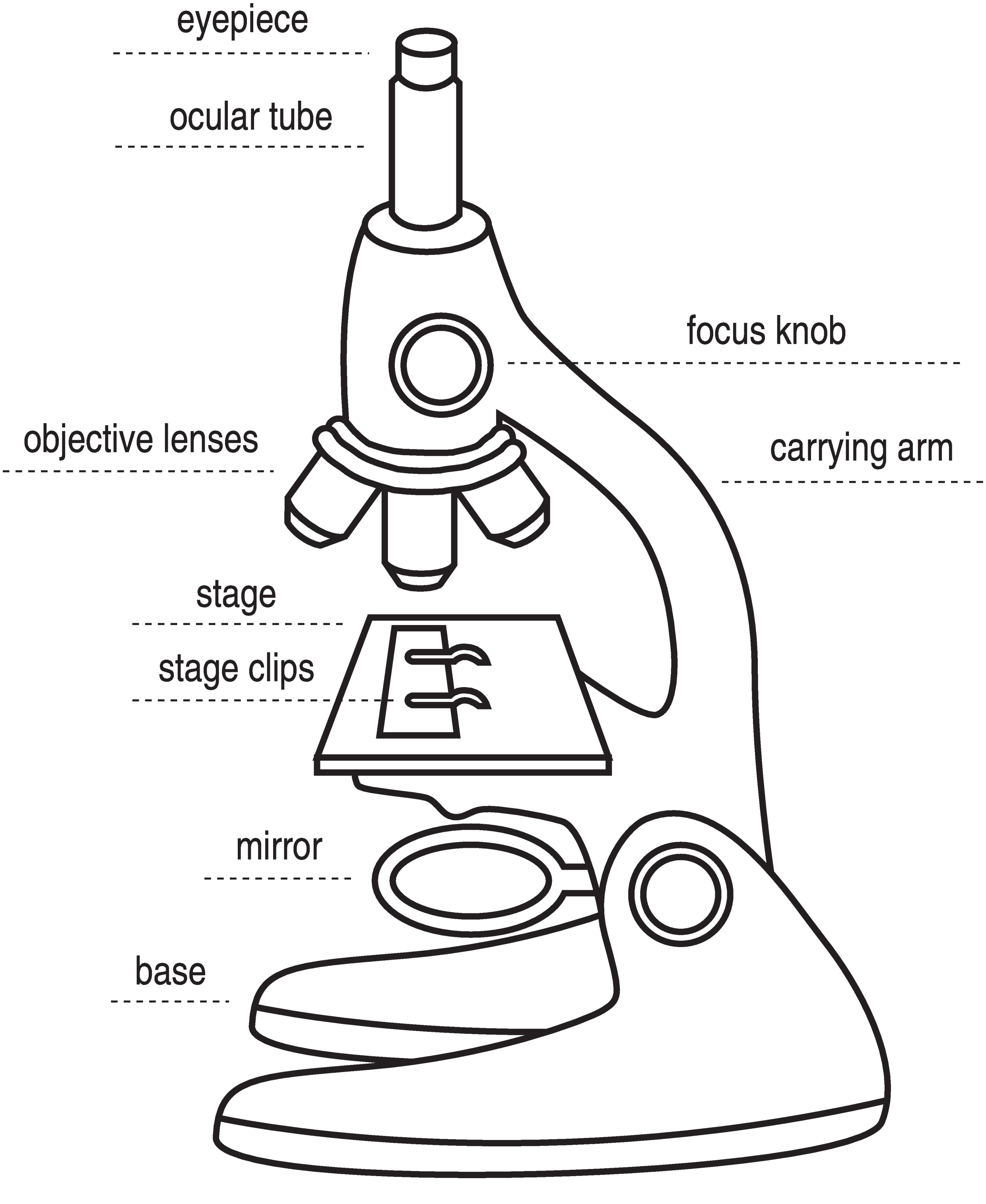

TEMPERATURE
Ice
Room Temperature
Heated


AMOUNT OF SAND
1/2 cup
1 cup
1 1/2 cup

MICROSCOPE DIAGRAM



MICROSCOPE DIAGRAM KEY



(Cut into sections of 5 clues each. Each team gets each section at appropriate times. See DAILY DIRECTIONS).

POND CLUES - 1

1. A **small public park** was built on the property next to Mr. Peterson's pond.
2. **Chemicals** such as pesticides can kill fish if they enter the pond water.
3. **Bacteria and parasites** that live in pond water can become more abundant in warm weather. When the weather becomes warm, these **bacteria and parasites** can kill fish and other pond creatures, especially if they are weakened for some reason.
4. The amount of **oxygen in water** depends on the temperature of the water, how many plants are growing in the pond, and the amount of sunlight.
5. If there is **not enough oxygen** in pond water, creatures in the pond can begin to die.

---

6. The **warmer the water**, the less oxygen it holds.
7. A month ago, there was a very **heavy rainstorm** at Peterson's Pond.
8. A **new factory** named Perry's Pesticides has recently opened near Peterson's Pond.
9. When there is **not much sunlight** around the pond, plants don't produce as much oxygen as they use.
10. As **water** in the pond **becomes warmer**, cold blooded fish become more active and use more oxygen.

---

11. Although some days have been warmer and others have been cooler than normal, the **average daily temperature** during the past six months has been normal for the area around Peterson's Pond.
12. When plants in the pond die, they decompose. As **plants decompose**, oxygen is used.
13. The **amount of sunlight** that has been hitting Peterson's Pond is normal for this time of year.
14. The **pH of a pesticide** would be in the acidic range.
15. **Heavy rains** can cause fertilizers used around ponds to run into pond water.

POND CLUES - 2

16. A **laundry detergent factory** called Sally's Soaps is located next door to Perry's Pesticide factory.

17. **Many people in** the neighborhood have been going to **the park** near Peterson's Pond to eat lunch when the weather is nice. Children also go to the park to play.

18. The **pH of laundry detergent** would be in the basic (alkaline) range.

19. **Fertilizer runoff** can be harmful to the pond. Because of the fertilizer, the plants in the pond will grow faster, which will decrease the oxygen in the pond.

20. The **amount of sunlight** around Peterson's Pond has been in the normal range so far this year.

---

21. People are so glad that litter has not been a problem in the **new park** located **near Peterson's Pond**.

22. Scientists have tested some fish and other creatures who have died near the pond and have determined that bacteria and parasites are **not the cause** of the creatures' deaths.

23. The amount of **oxygen in the pond water** is in the normal range.

24. **No fertilizer** has been used recently on the land around Peterson's Pond.

25. **Sally's Soap factory** made too much laundry detergent last month and was forced to store some of the detergent outside.

(Cut into this sheet into strips. Give each team member a different strip. You will need one set per team.)

T.E.A.M. ACTIVITY #1 - 1

1. The **catfish** is a scavenger which eats food that drops to the bottom of the pond.

   The **clam** breathes through its gills in the pond water.

   Frogs don't drink water like we do. They jump into the water from time to time because they need to keep their skin wet.

   Turtles who live near the pond are able to move on land and in the water.

---

2. **Ducks** spend a lot of time in the water near a pond, especially in spring, summer, and fall.

   Small crayfish move with their ten pairs of legs and catch food with their two front claws.

   The **snail** moves slowly along the mud with its "foot."

   Beavers change a stream habitat as they build dams from nearby branches and create ponds where they build their homes (called lodges).

---

3. When **crayfish** spot animals coming, they use their powerful tails to push themselves backwards through the pond water.

   Segmented worms, which look very much like earthworms without the rings, are commonly found in ponds.

   The **beaver's home** (or lodge) looks like a pile of sticks by the side of the pond. It has an underwater entrance, is hollow inside with a shelf that is above the water level of the pond.

   Snails eat algae and rotting vegetation. They eat with tiny teeth attached to their tongues.

4. Female frogs lay many jelly-covered eggs in the pond. **Frog eggs** hatch into **tadpoles**, which breath through gills like fish, although grown up frogs don't breath this way.

   When it is time to lay eggs, the **duck** will find a place near the edge of the pond to make a nest of grasses lined with feathers.

   The **clam** eats algae and plant debris in the pond.

   Goldfish lay their eggs in the warm, shallow water at the edge of the pond.

5. **Crayfish** search for small animals to eat as they move along the mud.

   Turtles find their food in the pond, but usually lay their eggs in holes they dig near the bank of the pond.

   Beavers are able to work underwater because muscles in their noses, ears, and throats tighten up and keep water out. Beavers also have see-through eyelids that act as goggles while they work underwater.

   Snails that live in the pond stay in the water.

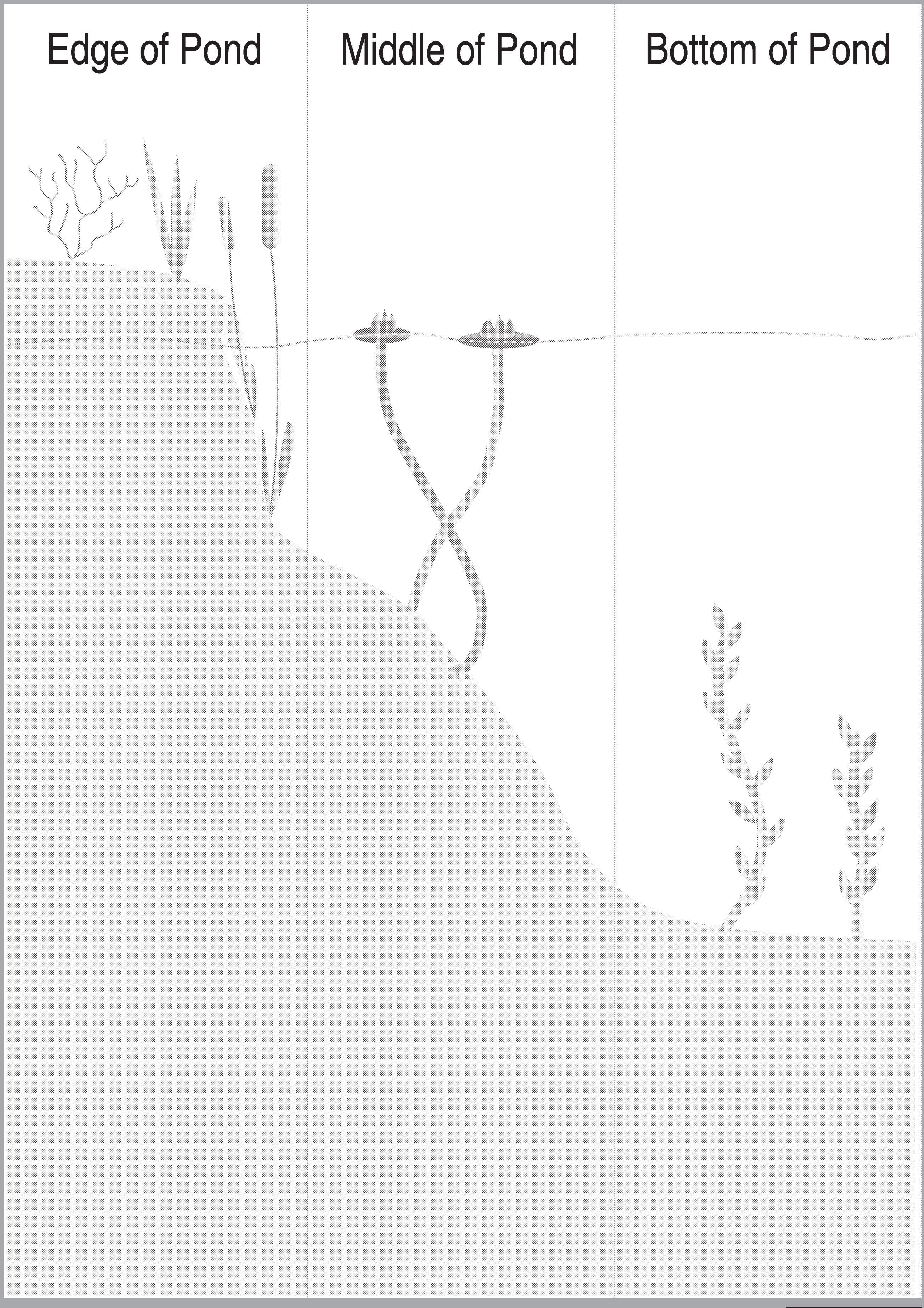
6. **Worms** living in ponds move through the mud, eating very small plants and animals.

   The **clam** siphons through its gills food that drops to the bottom of the pond.

   Frogs have long, sticky tongues which catch the insects, snails, and worms that they eat.

   Goldfish do well in a pond environment because they can survive in stagnant water.

T.E.A.M. ACTIVITY #1 RECORDING SHEET



Scientific Detective Record Form

Using the Scientific Method

1. What mystery are you trying to uncover? (“**the question**”)

2. What do you expect to be the answer to this mystery? (“**the hypothesis**”)

3. What clues have you uncovered so far, and what other clues will you look for to help solve this mystery? (“**data gathering**” and “**materials**”)

4. How will you determine if what you suspect to be true about the mystery is correct? (“**the experiment**” or “**method**”)

5. After completing steps 1-4, what do you now believe is the answer to your mystery? (“**conclusion**”)

6. As a result of doing this experiment, does a new mystery come to mind? (“**extending the experiment**”)

(Cut into this sheet into strips. Give each team member a different strip. You will need one set per team.)

T.E.A.M. ACTIVITY #2 - 1

1. **Some pond plants** are rooted in the mud, have very long stems, and tops that reach the surface of the water.

   Algae, the most important plant in a pond, is found in all three pond zones.

   Cattails can be found growing on the pond's bank.

---

2. In **the deepest part of the pond**, plants grow completely under water.

   Water hyacinth has underwater roots, but it reaches the water's surface.

   Duckweed is unusual because it does not fit into any of the described zones. It is a floating plant with roots that are not in the mud but instead dangle in the water.

---

3. **Plants growing** on the muddy bank or shallow water have roots in the mud, but the tops of these plants are exposed to air.

   Coontail plants grow completely under the water.

   Water lilies have roots in the muddy bottom, but the plant's leaves just reach the surface of the pond.

4. Plants that are not exposed to air are in the **submergent zone**.

   Pond weed has roots in the mud, but its leaves reach the surface of the water.

   Ferns grow on the bank or in the pond's shallow waters.

5. Plants in the **emergent zone** have roots in the muddy bank or shallow water.

   Bladderwort grows completely under the water in the pond.

   Wild celery has its roots in the mud, but its leaves reach the pond's surface.

6. In the **floating leaf zone**, the zone's name describes the plants in the zone. The plants' leaves float on the surface of the water while their roots and long stems are below water.

   No part of the **elodea plant** reaches the surface of the water in the pond.

   Cattail, a common plant associated with a pond, grows along the bank or in the pond's shallow water.

T.E.A.M. ACTIVITY #2 RECORDING SHEET

T.E.A.M. ACTIVITY #3 - 1

1. **Omnivores** eat both plants and animals.

   Wrigglers have mouth brushes to filter algae, microscopic animals, and debris from the water. (In case you were wondering, wrigglers is another name for mosquito larvae.)

   Carp eat plants that grow in and around ponds.

---

2. **Crayfish** feed on small animals.

   Tiny worms move through the mud at the bottom of the pond and eat minute plants and animals.

   Tadpoles begin their lives eating only plants, but they begin to eat small animals even before they become frogs.

---

3. **Salamanders** eat insects and small water plants.

   Herbivores eat plants only.

   Frogs catch food with their long, sticky tongues. They feed on insects, snails, and worms.

(Cut into this sheet into strips. Give each team member a different strip. You will need one set per team.)

T.E.A.M. ACTIVITY #3 - 2

4. **Snails** eat algae off the rocks and plants in the pond.

   Snakes eat frogs and small fish.

   Ducks often live in ponds because there are so many things that live in ponds that ducks like to eat: weeds, water plants, duckweed, insects, tadpoles, and other small water animals.

---

5. **Goldfish** eat plants that grow in the pond.

   Beavers are sometimes found in and around ponds. Their diet consists of roots, bark, branches of trees, and stems from plants such as grasses.

   Carnivores eat meat only.

---

6. The small **pill clam** doesn't eat the way we do. It siphons water through its gills to absorb oxygen and to eat algae and plant particles.

   Perch eat both plants and animals.

   Turtles may move slowly, but they enjoy eating many things around the pond, both plants and animals.

T.E.A.M. ACTIVITY #3 RECORDING SHEET

Omnivores	Herbivores	Carnivores

(Cut into this sheet into strips. Give each team member a different strip. You will need one set per team.)

T.E.A.M. ACTIVITY #4 - 1

1. **Snails** have hard shells which protect their soft bodies from predators.

   Crayfish have 10 pairs of legs and two claws. The claws, along with the shell that surrounds it, protect the crayfish's soft body from predators.

   Goldfish swim through the pond looking for plants to eat. Each goldfish moves its tail back and forth, using muscles attached to its backbone.

---

2. The **frog's skeleton** changes as it grows from a tadpole into an adult frog.

   Mosquito larvae are the small worm like creatures that develop into mosquitoes. These larvae stay at the surface of the pond water with their breathing tubes extending into the air.

   Protozoans are single-celled creatures which live at the bottom of the pond.

---

3. **Beavers** are mammals that live near a pond. Their webbed feet help them swim, and their tails are like rudders which help them steer through the water.

   Worms in the pond differ from those found on land. They are segmented, but their bodies are not made up of rings. Both types of worms do not have any bones in their bodies.

   Vertebrates are creatures that have backbones.

(Cut into this sheet into strips. Give each team member a different strip. You will need one set per team.)

T.E.A.M. ACTIVITY #4 - 2

4. **Turtles** are unique reptiles. They have two shells that are joined at the sides. The upper shell is attached to the turtle's backbone and ribs. As the turtle grows, the plates on both its shells grow a new layer every year.

   Mosquitoes are insects who live near ponds. Insects do not have bones of any kind.

   Newts are amphibians like frogs and salamanders.

---

5. A small **pill clam** is found on the bottom of the pond. It has a top shell and bottom shell which protect its soft, boneless body from predators.

   Catfish swim at the bottom of the pond, scavenging for food. The bones in the catfish's body help it swim.

   Ducks are a type of bird. They keep their bodies dry by spreading oil from an oil gland near their tails. Duck's tails extend from their backbones.

---

6. **Salamanders** are amphibians which live in a pond. They begin their lives with gills, but when they become adults, they lose the gills and must breathe the air. Thus, adult salamanders use their skeletons to support their weight on land and to move in water.

   Invertebrates are creatures that do not have backbones.

   Snakes live in or near ponds and feed on frogs and small fish. The snake's rib cage extends the length of its body.

T.E.A.M. ACTIVITY #4 RECORDING SHEET

Vertebrates	Invertebrates

1. **Ducks** feed on a variety of things in the pond, including water plants such as duckweed, insects, tadpoles, and other small animals.

   Tadpoles eat algae that grows in the pond.

   Frogs feast on insects, snails, and worms.

---

2. **Mosquito larvae** (also known as wrigglers) eat algae and microscopic animals.

   Tiny worms that live in the pond feast on very small plants and animals.

   Turtles eat a variety of food around the pond, including insects, worms, and plants.

---

3. **Algae** is a tiny green plant that is the most important plant life in the pond because many creatures eat it.

   Carp eat plants that grow in the pond.

   Snails eat algae off rocks and plants at the bottom of the pond.

T.E.A.M. ACTIVITY #5 - 2

4. The **pill clam** eats algae and plant debris that is siphoned through its gills.

   Crayfish crawl on the bottom of the pond through the mud to find the small animals they like to eat.

   Perch eat both small plants and animals around the pond.

---

5. **Protozoans** are one-celled animals that live on the bottom of the pond.

   Salamanders like to eat insects and small water plants.

   Goldfish feed on the plants in the pond.

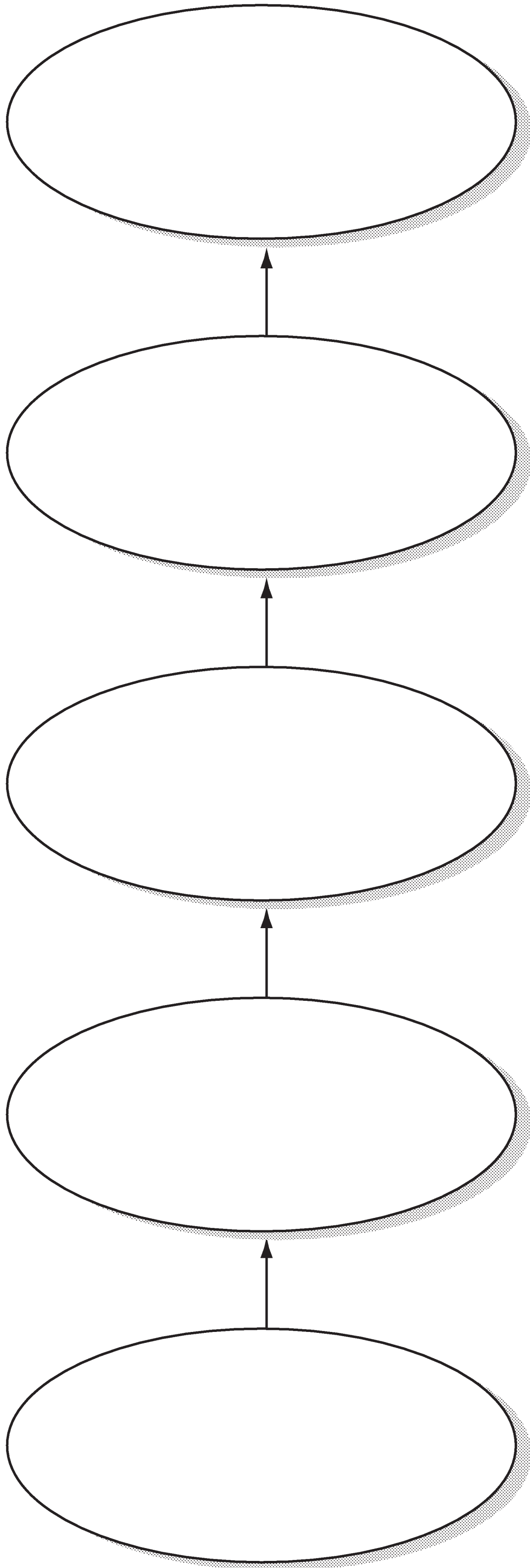
---

6. **Zoo plankton** are microscopic animals that feed on the algae that grows in the pond.

   Snakes feast on frogs and the small fish that live in and around the pond.

   Hawks will eat small snakes, frogs, toads, and small mammals.

T.E.A.M. ACTIVITY #5 RECORDING SHEET



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Release Form for Photographic Images

To Teachers:

To help illustrate to others the experiential activities involved and to promote the use of simulations, we like to get photographs and videos of classes participating in the simulation. Please send photos of students actively engaged so we can publish them in our promotional material. Be aware that we can only use images of students for whom a release form has been submitted.

To Parents:

I give permission for photographs or videos of my child to appear in catalogs of educational materials published by Interact.

Name of Student: ____________________________________(print)

Age of Student: ____________________________________(print)

Parent or Guardian: _________________________________(print)

Signature: ____ Date: ________________

Address:

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Phone: ____

Interact
10200 Jefferson Blvd.
Culver City, CA 90232-0802
310-839-2436

PETERSON'S POND

A simulation of solving a scientific mystery while learning about a pond's ecosystem

Student Guide

INTRODUCTION

The following edited newspaper articles are from the California News Service and the Associated Press. Read them carefully. Note their common theme—Pollution of our environment causes abnormalities and death! Then consider this question:

"If pollution causes abnormalities and death in lower forms of life, won't pollution also affect human beings since we are all part of the same food chain?"

When you have finished the three articles, read the letter from Mr. Peterson on page 3. In this simulation you will each become a "science detective" and work with an investigative team to solve the mystery of Peterson's Pond.

A snake parasite the cause of frog deformities?

Rocklin (California)—Grotesque deformed frogs have been found in the Midwest and other regions. Tuesday a California biologist said they may be linked to a snake parasite.

Charles Dailey, a biologist at Sierra Community College east of Sacramento, has been researching frogs at an Aptos pond in the Sierra foothills. It was there that he first noticed a possible connection linking the deformed frogs with the snake parasite.

Dailey found frogs with five or six legs and other deformities similar to the massive deformities other researchers investigated six years ago in a Santa Cruz County pond.

Puzzled Minnesota scientists may find this possible connection very interesting. They gathered last month at an emergency conference after hundreds of Minnesotans called a state hot line to report frogs with stump legs, missing eyes, and extra limbs.

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Learn Through Experience

Lake Mead carp found with deformities

Los Angeles (California)—Scientists have reported new research backing up theories that common chemical pollutants are hurting the bodies of wildlife.

National researchers have found damage to the reproductive systems of carp that swim in Lake Mead, a popular national park that is also a source of drinking water for Las Vegas and Southern California. Male carp were taken from a part of the lake that receives much of the treated and untreated waste flowing from the Las Vegas area. During examination, the fish showed abnormal female characteristics, the national biologists said.

At the annual meeting of the Society of Environmental Toxicology and Chemistry in Washington, D.C., a report of the Lake Mead conclusions was scheduled for release today.

The carp phenomenon is part of increasing evidence that chemical contaminants are causing problems for wildlife hormonal systems.

Fewer birds dying at Salton Sea but problems persist

San Diego (California)—Finally the water in California's largest lake is free of dead birds, victims of a mysterious outbreak of avian botulism, national researchers announced today. They estimate that 20,000 birds, including 20% of California's endangered brown pelican population, died over a period of several months at the Salton Sea.

"The disaster will occur again," said Clark Bloom, who manages the Salton Sea National Wildlife Refuge about 160 miles southeast of Los Angeles. "I don't know if as many birds will die soon, but this problem isn't going away."

During the die-off, scientists realized that there is not enough known about the ecology of the 242,000 acre lake that lies in both Riverside and Imperial counties. They stress that we are facing sick fish as well as dying birds. The scientists theorize that the birds were infected by the fish, primarily tilapia, that were rotting from bacterial infections. But how did the fish get sick? Was the disease caused by the sea's rising salinity, bacteria, pollution from Mexico, water temperature variations, air pollution, or other factors?

"The balances we're dealing with are delicate," said Milt Friend, director of the National Wildlife Health Center in Madison, Wisconsin. "An out-of–balance natural environment can result in different diseases breaking out," Friend said. Massive die-offs of both fish and birds have happened in the Salton Sea since water-hungry developers reshaped the Colorado River and created the lake in the early 1900s.

Now that you have read the newspaper articles on pages 1 and 2, please read this letter which was sent to you by someone in your community who knows about your teacher and your class. Then ask yourself, “How should we answer this letter from Mr. Peterson?”

Dear Students,

I am writing this letter to ask for your help in solving a problem I noticed during the past month. I have a pond in the back of my house. Local people refer to it as Peterson’s Pond because of my last name. As a little boy, I spent time at the pond with my Grandfather Frank, who owned both the house and pond. We fished together and talked about what lived in the pond. When my grandfather died, my father inherited the house and pond, and when he died, he gave me both of them.

The pond has been a happy place until just recently. A month ago I noticed that creatures from my pond were dying in higher numbers than they usually die. At first, I didn’t think much of this problem. However, I became really worried after I noticed dozens of dead fish last week.

I can’t think of any reason why these creatures started dying during this past month. The water in the pond looks fine, and I haven’t noticed any unusual happenings taking place. I really want to discover why so many creatures as dying before they all die. That is why I am asking for help.

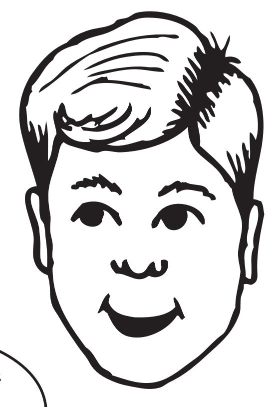
I would conduct this investigation myself, but I work during the day and I don’t have access to any scientific materials. My first thought was to ask some local scientists to study my pond and determine what was wrong. Then I remembered that students in school often have science materials available and I heard about your outstanding teacher. I hope you will become science detectives who find out why my pond’s creatures are dying.

I’m sorry to put pressure on you, but I need to have this problem solved quickly. If you can’t find out what the problem is in two weeks, I will have to bring in some scientists to discover what is happening. Otherwise, Peterson’s Pond may become an empty pond.

Please let me know as soon as possible if you will be able to assist me.

Sincerely,

Richard Peterson



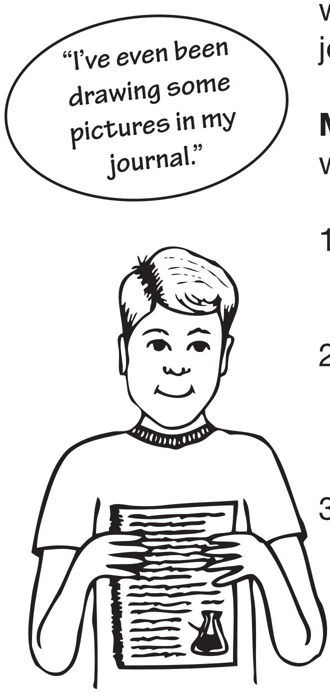

SALLY'S SOAPS
SALLY'S SOAPS
CITY PARK


Perry's Pesticides
PETERSON
WELCOME
J.KESSEL '97

YOUR SCIENCE JOURNAL

Scientists and detectives: Scientists are really detectives who work diligently to solve a problem. Like detectives who work for the police department, scientists have tools they use to solve mysteries. For example, both scientists and detectives keep notebooks (or journals). Here they carefully document what they find, observe, question, or believe to be a possible solution to the mystery they are attempting to solve.

Keeping a journal: As you work through the Peterson's Pond mystery, you will keep a journal, just as a real scientist or real detective does. This science journal will be important because in it you will record *everything you learn!*



Making an authentic journal: To keep an authentic—that is, a real and worthwhile—science journal, you should include the following elements:

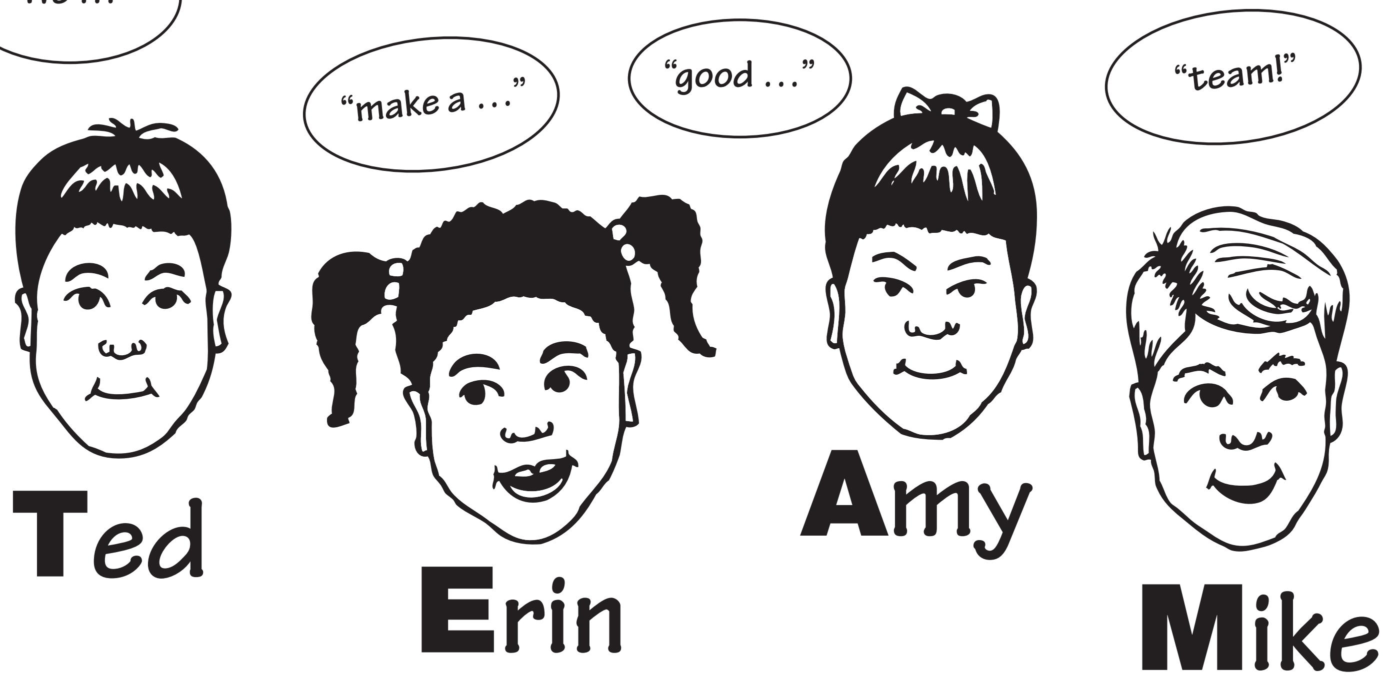
1. **Dates:** Every time you write in your science journal, you *must* include the date! This date will help you keep track of when activities, experiments, and observations were done.
2. **Complete descriptions:** Descriptions of all activities, experiments, and observations must be very complete so that someone with no knowledge of ponds or the activities and experiments you did could pick up your journal, read it, and understand *exactly* what you did.
3. **Illustrations:** Have you heard the expression, "A picture is worth a thousand words"? Illustrations will help someone reading your journal to understand even more than they would from words alone. Illustrations do not have to be complex; they can be simple diagrams or sketches. These illustrations will not only help someone reading your journal; they will also help you when you look back at your notes. Scientists often take pictures at different points in their experiments. If you have a camera, you may also take pictures as you work through this Peterson's Pond mystery.
4. **Important questions:** Scientists use their journals to record carefully any questions that occur to them as they are working. These questions help them determine what should be studied further. You should include questions you have in your science journal as you work through this mystery.
5. **Possible solutions:** Scientists are always thinking about the solution to the problem troubling them. In their journals, they record possible solutions whenever one comes to mind. *Do the same thing in your science journal.*

Good luck with your science journal. It will help you keep track of most of your thoughts and actions as you solve this intriguing mystery.

YOUR T.E.A.M. ACTIVITIES

What are T.E.A.M. Activities?

For the next few days, you will be doing T.E.A.M. Activities with your group members. T.E.A.M. stands for **T**ogether **E**veryone **A**ccomplishes **M**ore. Each T.E.A.M. Activity will not only give you important information about the pond that you will need to solve the mystery; it will also give you the opportunity to work together with other group members to solve a problem. As you do each activity, you will discover two things: that everyone in the group has something to offer and that many brains working together help tremendously when you are trying to solve a problem.



How are T.E.A.M. Activities done?

1. Your team's goal is to solve the problem presented to your group.
2. Each member of your group will be given some special information that no one else in your team has.
3. To solve the problem, all the information (clues) given to each group member will be needed.
4. Information can be shared only one way—*orally.*
5. No one may take or look at another group member's clues.
6. Everyone in the group has to participate! (Of course, clues may be repeated orally, if needed.)
7. Once all members have individually shared their clues, each group member should continue to contribute to solving the activity.
8. One or two group members should not do all the talking. Instead, everyone should give ideas or opinions.
9. And what is the most important skill you all must practice? *Listening!* It is very important that everyone listens carefully while other members of the group are talking since we can all learn from one another.

Good luck on your T.E.A.M. Activities! You will enjoy uncovering the information each day and using it to solve the Peterson's Pond mystery.

YOUR CHALLENGE PROJECTS (OPTIONAL)

These projects are an option in this PETERSON'S POND simulation. If your teacher chooses not to have your class do these projects, you can ask for permission to do one on your own time as extra credit.

1. **Organize** a group of students to hold a **science conference** or **town meeting** to discuss the implications of what they learned during this simulation. You can invite parents and grandparents, fellow students, school administrators, scientists in the area, and other interested people.
2. Ask your fellow students to **write a letter** to you, the principal, or their parents describing what they learned as a result of playing this simulation. Then write a summary of their comments.
3. **Write tips** for other students who may do this simulation in the future.
4. Using ideas and experiments that were done in this simulation, organize lessons to **teach other groups** of students or classes how **the scientific method** can be used to solve "mysteries" in our environment.
5. **Design another experiment** related to this simulation. An example might be one which would increase understanding of plant life in the pond.
6. **Investigate how scientists** working in this field **would conduct research** on the pond or another similar ecosystem. Then compare their research with your group's research.
7. **Write a fictional story** describing life in the pond and things that affect it. Write from the point of view of a creature living in the pond.
8. **Develop a public service announcement and program** such as "Smokey the Bear" to encourage people to protect their environment.
9. **Design a magazine advertisement or travel brochure** such as that associated with a national park (e.g., Yellowstone or Yosemite). Show the natural beauty and features of the pond's ecosystem.
10. **Develop any project** that interests you and is related to the topic.