Unit 2: The World of Water
Aquatic Ecosystems

Student Journal

Name

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The Scientific Method

Science is examined using a process known as the **scientific method.** There is no magic formula to doing science, but there are commonly accepted techniques that help scientists conduct fair and unbiased experiments.

The scientific method involves the following steps:

1. Develop a question about something interesting, puzzling or problematic;
2. Gather information about your questions;
3. Form a hypothesis (a proposed explanation or an educated guess) and make predictions based on the information gathered;
4. Perform experiments and make observations to test the hypothesis and predictions;
5. Analyze your findings or results of the experiments;
6. Make conclusions based on the findings; and
7. Share the results of your investigation.

Good scientists use their senses (in a safe manner) to investigate certain subjects; however, because some substances are harmful, we will not be using our sense of taste during these experiments.

Scientists also record their questions, predictions, observations, diagrams and findings in a field journal similar to this one so they may refer back to them at a later time. Keep in mind that scientists don't usually have answers until they seek them out by investigating and exploring possible answers to questions.

The beauty of science is that you don't have to know the answers before you get started!

Student Lab Safety Agreement

Hands-on activities are important to learning in any science program. Students must be safe while doing any science investigations.

1. Never eat, chew gum, or drink while doing these investigations.
2. Never taste any of the materials that you will be handling in these investigations.
3. Follow all instructions carefully. If you do not understand a direction or part of a procedure, ask the instructor before you continue.
4. Don't touch any equipment, or other materials until you are told to do so.
5. Keep hands away from your face, eyes, mouth and skin while using investigation materials. Wash your hands with soap and water after doing all experiments.
6. Clean, rinse, and wipe dry all work surfaces (including the sink) and equipment at the end of the experiment. Return all equipment clean and in working order to the proper storage area.
7. When transferring materials from one container to another, hold the containers over a table or sink.
8. Carry glass tubes in a vertical (straight up) position to prevent damage and injury.
9. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass.
10. When removing an electrical plug from its socket, grasp the plug, not the electrical cord. Hands must be dry before touching an electrical switch, plug or outlet.
11. Examine glassware and other containers before each use. Never use chipped, cracked or dirty containers.
12. Notify your instructor immediately if you find damaged equipment or materials. Look for cracks, chips, frayed cords, exposed wires, and loose connections. Do not use damaged equipment.
13. If you do not know how to use a piece of equipment, ask the instructor for help.
14. Do not place hot glassware in cold water – it may shatter.
15. Allow heated metals and glass to cool before use. Use tongs or heat-protective gloves if necessary.
16. Never look into a container that is being heated.
17. Do not place hot equipment directly on the desk. Always use an insulating pad. Allow plenty of time for hot equipment or tools to cool before touching them.
18. Use a wafting motion of the hand to check odors or fumes.
19. Never force rubber stoppers into glassware.
20. Know where the fire extinguisher, eyewash, shower, and exits are located.
21. Report all injuries to the instructor immediately.

I, ____________________________________ (student's name) have read and agree to follow all of the safety rules stated in this contract. I realize that I must obey these rules to insure my own safety, and that of my fellow students and instructors. I will cooperate with my instructor and fellow students to maintain a safe lab environment. I will also closely follow instructions provided by the instructor. I understand that if I violate this safety contract, I may be removed from the after school science laboratory.

____________________________________ ______________________________

Student Signature Date

____________________________________ ______________________________

Parent / Guardian Signature Date

LESSON 1

The Water Cycle

Investigation 1: Rain in a Jar

OBJECTIVE
In this investigation, you will learn how the Earth uses and recycles water in different phases called the water cycle.

Part 1: It's Raining in a Jar

GET READY!
You will conduct an investigation that creates a water cycle inside a jar. Do you think the Earth has the same amount of water today that was here when dinosaurs roamed the Earth millions of years ago?

PROCEDURE
1. Carefully fill the bottom of the glass jar with 2 to 3 inches (10 oz - 13.5 oz) of hot water.
2. Next, turn the lid of the glass jar upside down so that it acts as a small bowl, forming a seal over the jar.
3. Fill the lid with the colored ice.

PREDICT
What do you think will happen inside of the jar?

OBSERVE
Discuss your observations with your partner or group. What is happening inside the jar? Draw your observations.

Part 2: Cloudy with a Chance of Rain

PROCEDURE

1. Holding a can of aerosol spray (air freshener, for example), carefully lift the lid of colored ice and spray a small amount of aerosol spray into the jar.
2. Quickly replace the lid of ice back on the jar.

OBSERVE

Discuss and diagram the following observations:

- What do you notice about the water inside the jar?

- What states of water do you observe inside the jar?

Investigation 2: Making a Terrarium

OBJECTIVE

In this investigation you will observe the water cycle by creating a terrarium, a container that is used to keep and observe small living plants or animals.

GET READY!

BRAINSTORM!

Share what you know about water and the water cycle. Make a list of the group's ideas.

PROCEDURE

1. Pour 1-1 ½ cups of soil into the plastic container.
2. Use your finger or a pencil to make 3-4 holes (approximately 1 inch deep) into the soil.
3. Add a seed/bean to each hole and cover completely with soil.
4. Water the soil until well moistened and cover the terrarium with the lid or plastic wrap. Make sure tha the terrarium is well sealed.
5. Make a label for your terrarium using a marker and masking tape.
6. Place each labeled terrarium in a warm, sunny spot.
7. Draw a picture of your terrarium.

TIP
Keep the terrarium sealed to prevent water from escaping.

PREDICT

Predict what you think will happen in the terrarium over the next few days.

OBSERVE

Over the next several days, make some observations about what is happening inside the terrarium. Record and diagram your observations int he chart below.

- What do you observe happening in the terrarium?
- Is there evidence that the seeds have sprouted?
- Do you see water inside the terrarium? Where? Is the water in a liquid, gas or solid state?
- Remove the lid from the terrarium and rub some of the soil between two fingers. Is the soil wet? Has any of the water evaporated from the soil?

TIP
Seal the terrarium after you have examined the soil. If the terrarium is well-sealed, it will not need water for a few weeks. Water the soil only when it feels dry.

Terrarium Observations

	Observations	Results	Diagram Observations
Day ________			
Day ________			
Day ________			
Day ________			

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION

What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION

What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Words of Wisdom!

Flowing water never gets dirty.

--Chinese Proverb

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Use a thermometer to measure the temperature of the air inside the terrarium over a period of days. Create a chart of your results.
- Draw each phase of the water cycle that you observed in these investigations.
- Describe how temperature affects different forms of precipitation.
- Research and discuss ways that pollution might affect weather.
- Make a list of places you see condensation and evaporation every day.

Science @ Home!

Understanding Condensation

Water comes in different forms, or states. At room temperature, water exists in a liquid state. Water freezes into a solid state called ice at 0 degrees Celsius (32 degrees Fahrenheit). When water reaches a temperature of 100 degrees Celsius (212 degrees Fahrenheit), it changes from a liquid state to a gas state called water vapor. Water is constantly being reused in the water cycle. Here is an experiment that demonstrates how water is recycled. Ask an adult to help you with this experiment. Record your observations and results.

Materials

- 4 identical clear plastic cups
- Masking tape
- Marker
- Scissors
- Ice water
- A refrigerator and freezer
- Clock or watch with a minute hand

Investigation

1. Cut the masking tape into four (4) strips, about 1-inch in length.
2. Use the marker and tape to make labels for each cup. Label the first strip "A", the second strip "B", the third strip "C", and the fourth strip "D."
3. Place a strip of tape on each drinking cup.
4. Fill cup "A" with ice water and set it on a table. Wait for 1 ½ minutes (90 seconds).
5. Feel the outside of the cup and make observations:
   - What do you observe?
   - How did the outside of the cup get wet?
6. Place cup "B" on a table. Place cup "C" in the refigerator and cup "D" in the freezer. Do not place any water or other liquid in cups "B", "C", or "D".
7. After 7 minutes, remove the cups from the refrigerator and freezer. Line up the four cups on the table and make observations.

Explanation

Air contains water vapor. When warm air touches a cool surface such as the sides of a drinking cup, water vapor condenses (changes from a gas into a liquid) onto that surface. You've observed part of the water cycle when drops of water collect on the outside of a cup. Condensation is proof that there is water vapor in the air. In this investigation, water vapor moving around in the warmer air changed to a liquid when it came into contact with the cup of ice water. In order for condensation to take place, water vapor must collect onto a surface that is colder than the surrounding air. You will notice condensation on the outsides of the cup of ice water (cup "A"), and on the outsides of cups "C" and "D" when you remove them from the refrigerator and freezer, and water vapor begins to attach to the sides of the icy cold cups. You will not observe condensation on cup "B" because the air inside the cup is the same temperature as the air outside the cup, preventing water vapor from condensing onto the sides of the cup.

Source: http://www.teachtsp.com/products/productextras/SCISCI/watercycle.html (modified)

What's In the Water?
Biotic and Abiotic Elements in Aquatic Ecosystems

Investigation: Exploring Aquatic Ecosystems

OBJECTIVE
In this investigation, you will examine the relationship between biotic (living) and abiotic (non-living) elements in an aquatic ecosystem.

Part 1: Biotic and Abiotic Identification

GET READY!
For each part of this investigation, you will make predictions about whether the objects are living or non-living elements of an ecosystem.

BRAINSTORM
How do you know that something is alive? Record the characteristics of biotic (living) organisms in the chart below.

Biotic Organisms:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________

PROCEDURE
Examine the photo examples.

OBSERVE
- Which organisms in each of these examples is a biotic (living) organism? What evidence supports your answer?

- Which elements in each of these examples is an abiotic (non-living) element?

Part 2: Making Connections

You will now participate in an activity that shows the connections between all of the elements of an aquatic ecosystem.

PROCEDURE

1. Think about the relationship between biotic and abiotic elements of an aquatic ecosystem.
2. Choose one of the nametags.
3. Listen for directions on how to play the game.

OBSERVE

- What if the water in the ecosystem became totally polluted? How would this affect the connections made in the string game?

- What if one of the biotic elements was totally eliminated from the ecosystem? How would this affect other biotic elements? Give an example.

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION
What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION
What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Define the following terms in your own words: ecosystem, biotic, abiotic.
- Make a data table of the biotic and abiotic elements found in a local body of water and the source of pollutants in the water.
- Write a poem about the biotic and abiotic elements found in your favorite aquatic ecosystem.
- Make a web of biotic and abiotic elements found in an ocean or a pond.

Science @ Home!

Turbidity

You will learn how to measure turbidity -- the amount of sediments suspended in water -- and learn how turbidity affects aquatic life.

Materials

- 2 sheets of black construction paper
- 1 sheet of white paper
- Tape
- Large, clear glass jar
- Empty soda can or jar lid
- Flashlight
- Dirt
- Water

Procedure

1. Line up two pieces of black construction paper and trace a circle in the center using the empty soda can.
2. Cut out the circles.
3. Tape the two pieces of construction paper around the glass jar so that the two holes are opposite each other. You might have to trim the construction paper so your pieces fit the jar.
4. Make sure that there are no gaps between your pieces that will let light through, and that the second circle is on the opposite side of the jar from the first circle.
5. Fill the jar three-quarters full with tap water.
6. Using the flashlight, shine the beam of light through the holes in the side of the jar. On the opposite side of the jar, hold up a sheet of white paper about one inch from the holes.
7. Observe and note the level of light intensity (low, medium, high).
8. Slowly add measured amounts of dirt to the water and monitor the change in light intensity.

Explanation

As you add more dirt to your jar, you increase the turbidity of water, and less light is able to shine through. Turbid water can also be described as "murky." The clearer a body of water is, the lower its turbidity. When turbidity is high, solid particles (such as sediment) can block light that aquatic plants and organisms need to survive. Sediment can also clog the gills of fish. Suspended solids can also absorb heat from sunlight, raising the temperature of the water. As the water warms, it loses its ability to hold oxygen. This causes dissolved oxygen levels to drop, further reducing the number of plants and animals that can live in the water.

Source: http://www.tryscience.org/experiments/experiments_begin.html?turbidity (modified)

Investigation: Freshwater Ecosystem in a Bottle

OBJECTIVE

In this investigation, you will build a small freshwater ecosystem in a bottle.

Part 1: Setting the Stage

GET READY!

BRAINSTORM

Brainstorm and identify some different bodies of water that you know. Identify which bodies of water fall into the freshwater category and those that fall into saltwater category. As the group is brainstorming, make a list of the ideas that come to mind:

PROCEDURE

1. Use your markers to draw a line around the soda bottle without holes. Draw the line approximately two or three centimeters from the curved top end of the bottle.
2. Next, draw a line around the bottle with holes two or three inches from the curved bottom end of the bottle.
3. Cut along each line with a pair of scissors.
4. Use the masking tape and marker to put your name on the bottle without holes. The bottom half of the other soda bottle with holes will serve as the lid to your freshwater ecosystem.
5. Fill the bottle without holes with 6 cm (2 ½ inches) of sand.
6. Then, slowly fill the bottle two thirds of the way with dechlorinated or spring water, trying not to disturb the sand.
7. Plant three Elodea plants securely in the sand at the bottom of the soda bottle.
8. Sprinkle a scoop of Duckweed on the surface of the water.
9. Set the bottles aside overnight to allow the sand to settle.

OBSERVE

- Record the biotic and abiotic elements that you have added to the freshwater ecosystem.

- Make observations about the Elodea plants and the Duckweed.

- Draw and label your freshwater ecosystem.

- Measure and record the water temperature of your ecosystem.

Part 2: Adding Some Key Players

SAFETY TIP
Always wash your hands before and after handling live organisms.

GET READY!

1. Observe the freshwater ecosystem bottles after they have been allowed to settle and record these observations in your journal.
2. Measure and record the water temperature of the ecosystem.
3. Make observations about the water snails and the guppies in their cups and share your observations with your partner or group.
4. Draw the organisms in the space below.

5. You will now add these biotic organisms to your ecosystem.

PROCEDURE

1. Gently add the two snails to the ecosystem.
2. Next, add the guppies to the ecosystem.
3. Observe how the snails and guppies behave when they are added to the bottled ecosystems. Discuss your observations with your partner or group.
4. Next, place the bottled ecosystems in a well-lit area, but not in direct sunlight.
5. Feed your guppies with a very small pinch of fish food.

PREDICT

What do you think will happen to your freshwater ecosystem over time?

Part 3: Watch What Happens

OBSERVE

You will be making the following observations about your ecosystems each week over the next few weeks:

- Has the color of the water changed? If so, how? Why do you think these changes occurred?
- Did you notice any change in water temperature? If so, how?
- Has there been any plant growth or changes?
- How did the organisms behave?
- Did any of the populations change?
- Draw and record and draw your observations each time.

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION

What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION

What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Take pictures of the ecosystems at each observation and create a book or webpage.
- Create a table for the data collected.
- Create line graphs for the changes in water clarity, water temperature, plant growth and animal populations.
- Make a double bar graph comparing the number of animal populations at the beginning and at the end of the activity.

Science @ Home!

Build an Underwater Scope

Sometimes the best way to observe what happens underwater is to jump right in. Since humans can't breathe underwater, we need special equipment to explore aquatic environments. SCUBA (Self Contained Underwater Breathing Apparatus) divers use air tanks or submarines to study aquatic organisms and their habitats. One way to get closer to the animals that make their homes in lakes, rivers, and streams is to make your own underwater scope.

Materials

- An old coffee can or large juice can
- Plastic wrap
- A sturdy rubber band
- Scissors
- Can opener

Procedure

1. Ask an adult helper to help you remove both ends of the coffee can using a can opener.
2. Next, cut a piece of plastic wrap to fit over one end of the can. Make sure it covers the sides of the can by at least two inches.
3. Stretch the plastic wrap tight and secure it with a rubber band. You may want to tape the edges of the plastic wrap down with duct tape or some other strong tape.

Practice placing your underwater scope with the plastic side down in a tub of water. With the open end of the can facing up, place the covered end of the tube about one inch below the surface of the water. Look down into the water through the scope to discover a whole different world!

Source: http://www.dnr.state.wi.us/org/caer/ce/eek/cool/h20scope.htm

Marine Ecosystems

Investigation: Brine Shrimp Hatcheries

OBJECTIVE
In this investigation, you will learn about different types of marine ecosystems and explore the life cycle of a brine shrimp.

Part 1: Salty Shrimp

GET READY!

BRAINSTORM
Brainstorm what you know about marine ecosystems. As the group is brainstorming, make a list of the ideas that come to mind. What is the water like in a marine ecosystem?

PROCEDURE
You will conduct an experiment to test how water salinity affects the hatching of brine shrimp.

1. Examine the brine shrimp eggs (cysts) under the magnifying lens. Describe how the brine shrimp eggs look and draw them in the space below:
2. Fill each container with 500 mL (2 cups) of water. Record the amount of water in the chart below.
3. Choose three different quantities of salt to test in this experiment and record these amounts in the chart.
4. Use the masking tape and markers to label each container with the amount of salt you will add to the containers of water.
5. Measure and add the amounts of salt your group has selected to each of the three containers. Record the amount of salt added to each container in the chart below.
6. Next, add ½ tsp of brine shrimp eggs to each of the three containers.
7. Use thermometers to measure the temperature of the water in each container and record these temperatures in the chart.
8. Allow the containers to sit for a few days, but first make predictions below.

PREDICT

Make and record your predictions. What do you think will happen to the brine shrimp eggs?

Salinity and Brine Shrimp Hatching Chart

	Container One	Container Two	Container Three
Amount of Water			
Amount of Salt			
Amount of Brine Shrimp Eggs			
Temperature			
Prediction			
Observations			

Part 2: Brine Shrimp Life Cycle

OBSERVE

Make observations about the larvae once the eggs have hatched. How do the larvae look in the container and under the microscope? Draw the larvae in the space below:

Part 3: What If?

GET READY!

BRAINSTORM!

When we change one part of an experiment to see how it affects our results, this change is known as a variable. Brainstorm some additional variables that could be tested. Which variables would you want to change?

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION

What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION

What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Create a table for the data collected.
- Calculate the salt-to-water ratio for each container.
- Create a bar graph for each group's finding.
- Photograph the brine shrimp at different stages in their life cycle.

Science @ Home!

Marine Ecosystems

In this experiment, you and your adult helper can demonstrate that ocean currents are influenced by changes in water density and observe how temperature and salinity affect water density.

Materials

•NOTE: Advanced preparation is needed for this experiment.

- Food coloring
- Ice cube tray
- Fish bowl, small aquarium or any glass bowl of similar size
- Salt
- Small cup
- Hot tap water (43 °C or 110 °F)
- Thermometer

Procedure

Set up

1. Several hours before you begin the experiment, add 5 - 7 drops of food coloring to a small amount of water.
2. Pour the colored water into an ice cube tray to make 1 colored ice cube. Make sure the color is very dark.

Temperature (Part 1)

- Fill a fish bowl, aquarium, or other glass container to the rim with room temperature water. Let it stand for about a minute so that the water will have a chance to settle before you start.
- Place the colored ice cube into the water very gently and observe for 1 minute or more. Do not disturb the glass container until after the ice cube has completely melted.

Temperature (Part 2)

- Empty the glass container and then refill it with fresh water at room temperature.
- Run hot water until the temperature is at least 110 °F (43 °C). Fill a small cup half-full with this water. Add 5-7 drops of food coloring until the color is very dark. Very gently pour this colored hot water into the tank. Observe for a minute or more.

Salinity

- Empty the fish bowl or glass container and then refill it with fresh water at room temperature.
- Fill the test tube or cup half-full of colored salt water; use 5-7 drops of food coloring to give it a dark color and 1/2 teaspoon of salt. Very gently pour the colored salt water into the tank and observe.

Explanation

Ocean water is salty and usually cold. Most ocean water is less than 36 °Fahrenheit. But in the tropics (the warmest and most humid regions of the Earth), surface water may reach 82 °Fahrenheit, and water can be much hotter near underwater volcanoes. Differences in water density associated with temperature and salinity play an important role in shaping ocean currents.

Source: http://www.mos.org/oceans/motion/density.html (modified)

Water Body Salinities I

Investigation: Water Detectives I

OBJECTIVE
In this investigation, you will conduct experiments using samples from different bodies of water to learn about salinity.

Part 1: Oceans, Rivers and Estuaries

GET READY!

BRAINSTORM!
Brainstorm what you know about oceans, rivers and estuaries. Make a list of the ideas that come to mind.

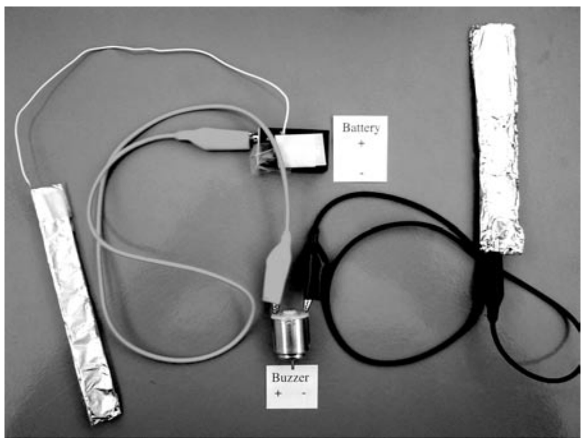
PROCEDURE
1. Label the three bodies of water that will be examined during this investigation on your map. (Map on other side of page).
2. Create a key on your map for the salinities of river water (0 - 3 ppt), estuarine water (0 – 30 ppt) and ocean water (32 - 37 ppt), assigning a different color to each.
3. Color each of the three bodies of water with the matching salinity color from the key.

Outline map of the state of New Jersey

Part 2: Conductivity

GET READY!
You will now create an electrical circuit, a device that creates a path for electricity to follow. You will test each water sample to see if any of the samples can complete the electrical circuit by lighting the bulb or ringing the buzzer.

PROCEDURE
1. Wrap the popsicle sticks in aluminum foil.
2. Next, tape or clip the red wire of the light bulb or buzzer to the positive end of the battery (on a 9-volt battery the positive and negative symbols can be found on the sides).
3. Tape or clip one foil-covered popsicle stick to the black wire of the bulb or buzzer.
4. Tape the other foil-covered popsicle stick to one end of the 12-inch length of insulated wire.
5. Next, tape the end of the other 12-inch length of wire to the negative end of the battery. (It can also be clipped directly to the battery.)
6. See if the circuit is complete by touching the foil-wrapped popsicle sticks together. (If the circuit is complete, the bulb will light or the buzzer will ring.)
7. Half-fill each separate plastic cup with the water samples, and label the cups #1, #2, and #3.



conductivity set-up

PREDICT
Do you think any of the solutions will conduct electricity? Why do you think so?

OBSERVE
- Now, place the ends of the popsicle sticks into the first water sample, keeping the sticks apart in the water. Record your observations.

- Repeat these steps with the two remaining water samples recording your observations.

TIP
Dry the popsicle sticks between each test.
Make sure your circuits still work between each test by touching the sticks together.

Part 3: Evaporation

GET READY!

You will now conduct additional experiments in your attempt to determine the identity of each water sample.

BRAINSTORM

- What happens when we leave water out in the open over time?
- How does this relate to the water cycle?

PROCEDURE

1. Fill three separate cups with 60 mL (1/4 cup) of each of the three water samples.
2. Mark the water level on each cup with a marker.
3. Label the three cups #1, #2, and #3 to match the water samples.
4. Place the cups on a sunny windowsill.

PREDICT

What will happen to the water in the containers if you leave them out overnight?

OBSERVE

Check the water samples after 24 hours, 48 hours, and daily if possible for 1 week. Mark the water level on your cup each time you check the sample. Record your observations.

- How much water evaporated after each time interval? Draw what you see in the Data Recording Table.
- Which sample(s) do you think were freshwater? Which were saltwater?

NOTE: You will continue this investigation in Water Detectives II.

Water Detectives I Data Recording Table

Test	Sample #1	Sample #2	Sample #3
Conductivity Test • Did the buzzer ring / bulb light?			
Evaporation Test • Describe and draw what you observed in each cup, and the date you made the observation.			

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION
What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION
What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Word Play

If we don't conserve water we could go from one ex-stream to another.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Try painting with colored saltwater and colored freshwater with a paintbrush on two different pieces of construction paper. Observe your results after the water has evaporated.
- Take a field trip and collect real river, ocean and estuary water samples. Compare your results with this lesson.

Water Body Salinities II

Investigation: Water Detectives II

OBJECTIVE
In this investigation, you will continue to conduct additional experiments to determine the identity of each water sample.

Part 1: Make a Hydrometer

GET READY!
In this experiment, you are going to make hydrometers. Hydrometers measure the density of a liquid.

BRAINSTORM
Brainstorm what you know about density and salinity.

PREDICT
Based on the previous tests, can you predict which water sample will have the greatest density? The least? Why do you think so? Record your predictions.

PROCEDURE
1. Press a small ball of clay the size of a marble into one end of a straw to form a plug.
2. Starting at the top of the straw, draw horizontal lines with a permanent marker down the length of the straw at 1 cm intervals.
3. Half-fill one of the cups with tap water.
4. Put the straw hydrometer clay-end down into the tap water.
5. Remove or add clay until the hydrometer floats without touching the bottom of the cup.
6. Using your hydrometer, test each of the water samples in the cups.
7. For each sample, count the number of markings below the surface of the water and record the number in the Data Recording Table.


hydrometer set-up

OBSERVE
Make and record your observations in the Data Recording Table.
Which water sample had the greatest density? The least?

Part 2: Freezing Point

GET READY!

BRAINSTORM
What happens to water when it gets cold?

PROCEDURE

1. Label three sections of a plastic ice cube tray: #1, #2 and #3.
2. Fill each section of the tray with the matching water sample.
3. Place the trays in the freezer.

OBSERVE

Make observations and record the temperature of each water sample after 1 hour, 24 hours and 48 hours in the Data Recording Table.

Water Detectives II Data Recording Table

Test	Sample #1	Sample #2	Sample #3
Hydrometer/Density Test • How many marks on the hydrometer are below the surface of the water in each sample? • Describe and draw what you observed.			
Freezing Test Describe and draw what you observed in each section of the ice cube tray.			

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION

What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION

What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Words of Wisdom!

Where water is the boss, there must the land obey.

-- African Proverb

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Try painting with colored saltwater and colored freshwater with a paintbrush on two different pieces of construction paper. Observe your results the next day after the water has evaporated.
- Take pictures of the tests for each sample and make a book or showcase them on the Internet.
- Take a field trip and collect real river, ocean and estuary water samples. Compare your results with the results from today's investigation.

Science @ Home!

Salty Water

All water, even rain water, contains dissolved salts. But not all water tastes salty. Water tastes fresh or salty according to each individual. Your taste buds determine what is fresh and what is salty to you. Try this simple experiment.

Materials

- Measuring teaspoon
- Salt
- Tap water

Procedure

1. Fill three glasses with water from the kitchen faucet.
2. Drink from one and it tastes fresh even though some dissolved salts are naturally present.
3. Add a pinch of table salt to the second, and the water may taste fresh or slightly salty depending on a personal taste threshold and on the amount of salt held in a "pinch."
4. Add a teaspoon of salt to the third cup. This cup of salt water represents seawater. This water is too salty to drink, and will not be appealing to your taste buds.

TIP
It is not healthy to drink salty water because it can cause dehydration.

Explanation

The ocean contains very high amounts of dissolved salt, making the water too salty for human consumption. Oceanographers (scientists who study oceans and marine organisms) are very interested in salinity levels. Salinity describes the amount of salt found in water. Salinity is often expressed as "parts per thousand" (ppt). The average salinity level of the ocean is 35 parts per thousand, which means that about 35 pounds of salt is found in every 1,000 pounds of marine water. Ocean salinity can range from approximately 32 – 37 ppt.

References: U.S. Geological Survey & NASA (Goddard) Space Center

Investigation: Exploring Estuaries

OBJECTIVE
In these investigations you will learn what an estuary is and explain its important role in the environment.

Part 1: Salt and Water

GET READY!
You will dissolve salt crystals in water to observe its effects on water. Document your predictions, observations and findings.

OBSERVE
Take a pinch of salt and examine it using the magnifying lens or microscope. Share your observations with your partner or group. Sketch what you see in the space below:

PROCEDURE
1. Fill the cup with 100mL (about 3½ oz) of water.
2. Next, pour 1 tablespoon of salt into the cup and stir the solution until all of the salt dissolves.
3. Using the eyedropper, place one drop of the saltwater solution on a microscope slide or onto the clear plate.
4. Use the magnifying lenses or microscopes to examine a drop of the saltwater solution.

OBSERVE
Share your observations of the saltwater solution with your partner or group.
How would you describe what you see?

Part 2: Making a Salt Wedge

You will now make a model of a salt-wedge estuary. Salt wedge estuaries occur when the mouth of a river flows directly into seawater.

PROCEDURE
1. Place a small wooden block or book securely under one end of the baking dish, raising it approximately one inch from the table.
2. Next, make several tiny holes in the bottom of the cup using the tip of a pencil or a pair of scissors.
3. Drop marbles, small stones or pebbles in the cup and place the cup into the lower end of the baking dish.
4. Now, pour a liter of the room temperature tap water into the pan until it is about ½ inch from the top of the pan.
5. Allow the water to settle.
6. Add several drops of food coloring to the ½ liter saltwater solution, making it a dark-colored solution.

PREDICT
Before you add the saltwater solution to the tap water in the pan, make a prediction about what will happen when you pour the saltwater solution into the freshwater. Record your prediction.

OBSERVE
Now, slowly pour the saltwater solution into the cup of marbles, being careful not to overfill the cup. Make observations as the water settles in the baking dish. Look at the pan from the side at the table level & diagram what you see.

Part 3: Plant Dehydration

You will now investigate the effects of saltwater on freshwater aquatic plants. Hypothesize why some organisms are salt-tolerant while others are not.

PROCEDURE
1. Fill each graduated cylinder or soda bottle with 1000 mL (about 4 cups) of water and label the containers #1, #2, #3 and #4 using the masking tape and marker.
2. Measure 1 tablespoon of salt and pour the salt into container #1.
3. Next, measure 2 tablespoons of salt and pour the salt into container #2.
4. Measure 3 tablespoons of salt and pour the salt into container #3. No salt will be added to container #4.
5. Use a long-handled spoon or stirrer to dissolve the salt in each container of water.

OBSERVE
Examine the freshwater plants and share the following observations with your partner or group. What is the color of the plants? The texture? Shape?

PREDICT
Predict what will happen to freshwater plants when they are added to the containers of water/salt. Document your predictions.

Place one plant into each of the containers labeled #1, #2, #3 and #4. Observe the plants over the next several days and document your observations in the chart provided.

Freshwater Plant Observations

	Day 1	Day __	Day __	Day __
1 Tbsp salt				
2 Tbsp salt				
3 Tbsp salt				
water, no salt				

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION
What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION
What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Repeat the salt-wedge experiment using smaller amounts of salt. What is the smallest amount of salt that will form a wedge?
- List some of the ways that humans rely on estuaries.
- Research and compare plants from saltwater and freshwater environments. How are they similar? Different? Cut open the stems and leaves of the plants and examine them using a microscope or magnifying lens.
- Research estuarine organisms. Write a "name poem" using the names of plants and animals that live in the estuary. Each letter of an organism's name serves as the first letter for each line of the poem; for example, C - R - A - B:

  Can walk sideways
  Really small
  Algae it eats
  Bottom dweller

Science @ Home!

Soil Salination

Soil salination occurs when high levels of salts build up near the surface of soil. Salts are deposited in soil as groundwater flows through soil.

Materials

- 2 plastic or paper cups
- Cotton balls
- 10 bean seeds
- Salt
- Clear plastic wrap (optional)

Procedure

1. Cover the bottom of two cups with cotton balls.
2. Sprinkle some salt over the bottom of one cup. Label this cup “salt added”.
3. Place five seeds in each cup. It helps if you place the seeds with their grooved side upwards.
4. Wet the cotton balls in both cups and put in a light place.
5. Keep the seeds moist - you can cover the cups with clear plastic wrap to prevent the seeds from drying out.
6. Within four or five days, the seeds should begin to grow. Which seeds begin to grow first - the seeds with or without salt?
7. Observe the seeds growing for a few more days. What difference do you see?

Explanation

When it rains or snows, water flows into underground sources of water called aquifers. The uppermost layer of water in an aquifer is called the water table. Groundwater naturally contains small amounts of salts and minerals. As groundwater from the water table reaches the surface of the soil, it deposits salts and minerals into the soil. When water evaporates (changes from a liquid to a gas) from soil, it leaves behind a higher concentration of salts in the surface of the soil. Large amounts of salt in the soil (salination) cause major environmental problems, especially when farmers use groundwater to irrigate (water) their crops. High levels of salt are toxic to plants and other organisms that absorb nutrients from soil. When salt levels become too high, plants begin to die. To reduce the impact of soil salination, farmers plant trees and other salt-tolerant crops that help lower the water table.

Source: http://www.tryscience.org/experiments/experiments_saltsoilandseeds_athome.html

Wetlands

Investigation: Wetlands Discovery

OBJECTIVE
In this investigation you will learn what a wetland is and explain its important role in the environment.

Part 1: Build a Wetlands Model

GET READY!
You will create a model of a wetland to learn how it absorbs and filters water from the environment.

PROCEDURE
1. Measure the aluminum pan and divide the pan into three parts, identifying each part by making a line on the bottom of the pan with a permanent marker.
2. Next, flatten a piece of clay and use it to cover 1/3 of the aluminum pan, being sure to seal the clay along the edges of the pan.
3. Place the sponge firmly in the middle third of the pan. The sponge should fill the middle third of the pan and touch the edges of the pan.
4. Layer about 1 cm of potting soil onto the clay bottom. This represents land.
5. Add enough water to cover the final 1/3 of the pan.

OBSERVE
Record your observations. Which piece of this model do you think represents the wetlands?

PREDICT
You will make it "rain" on your wetland model. First, predict what will happen when it rains on the wetland. Record your prediction.

OBSERVE

- Using the ½ liter water bottle or spray bottle, slowly pour water onto the land. Discuss your observations with your partner or group.
- What happened as you poured water onto the wetland model?

- What would happen if you tried this experiment again without the sponge to act as a barrier? Try the experiment again without the sponge. Remove the sponge and observe what happens when you pour water onto the soil.

Part 2: Match-Making

PROCEDURE

You will now learn about plants and animals that make their homes in wetland habitats.

1. Look at pictures of different types of wetlands such as bogs, swamps and marshes.
2. Listen to the description of each wetland type.
3. Match the pictures with the descriptions.

OBSERVE

- What characteristics do you observe about the different wetlands in each picture?

- Look at the pictures of different types of plants and animals that live in or near wetlands. Try to match the plants and wildlife to each type of wetland. Make observations and record your matches in the space provided.

- What characteristics do you see in the plants? What about the animals?

- Can you match the proper wetland to each plant, bird, fish, amphibian, and mammal?

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION
What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION
What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Draw the plants and animals found in the wetlands.
- Use a Venn diagram to compare and contrast different types of wetlands. What plants and animals do they have in common? What are the differences?
- Write a magazine article about the importance of wetlands in your area.
- Do a mock interview of one of the wetland animals -- what does this animal have to say about what is happening in its habitat?
- Think of some of the ways that plants and animals would have to adapt in order to live in a wetland habitat. Adaptations can be physical (such as the size or shape of the teeth; the color, or the shape or type of the animal's body), or behavioral (activities that help an animal survive by avoiding predation or capturing prey). Make a list of your ideas.
- Participate in a community project that improves habitats located near water sources such as wetlands.
- Get the New Jersey freshwater wetlands map from the NJ Department of Environmental Protection's Maps and Publications Office at (609) 777-1038, or, check to see if your public library has a GIS (Geographic Information System) computer system to view the maps on its computer.

Science @ Home!

Purposes for Wetlands

Many people and organizations are spending much time and money to protect the remaining wetlands in the state of New Jersey. Adult helpers and students will explore the three main functions of a wetland and why wetlands are an important component in the ecosystem.

Materials

- Coffee filter
- Gravel
- Dirt
- Grass or pine needles
- 1 quart of water
- Strainer
- Sand
- Clear container
- Pitcher
- Wooden spoon

Procedure

1. Mix the gravel, sand, dirt, grass/pine needles and water in the pitcher stirring with the wooden spoon.
2. Place the coffee filter in the strainer and position the strainer on top of/over the clear container.
3. Slowly pour all contents of the pitcher into the strainer.
4. Make observations about what is happening in the pitcher.
5. Measure the amount of water in the clear container.

Explanation

Wetlands are more than just places with “wet land”. Wetlands provide a habitat for a variety of plants and animals, including food, water and shelter. The coffee filter removed the mud, grass, sand, and gravel from the water. Wetlands serve as filter for the environment, cleaning pollutants and debris from water. Wetlands also help control flooding. The tangled mass of plants, soil and roots help reduce the impacts of heavy storms and prevent soil erosion. Wetlands are a very important part of the ecosystem and it is important that we protect them.

Source: http://www.rockwood.k12.mo.us/ccl/mcclintock/Wetlands/wetland%20experiment2.pdf (modified)

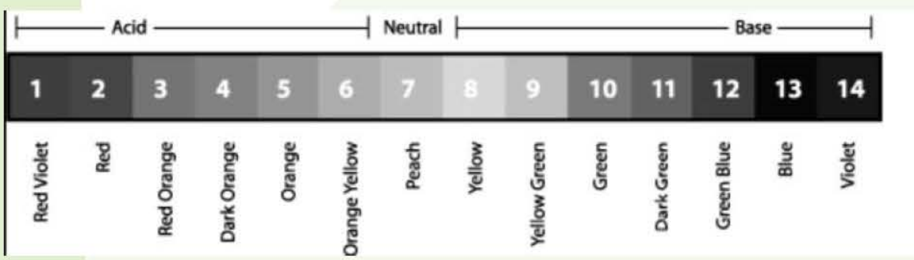
Investigation: Understanding pH

OBJECTIVE
In this investigation you will examine how pH levels affect water quality in an aquatic ecosystem.

Part 1: Acid or Base?

GET READY!
You are going to test various liquid samples to determine their pH levels. The pH scale ranges from 0 to 14. A pH of 7 is considered to be neutral. pH levels from 1 - 6 are considered acidic. Solutions with pH levels from 8 - 14 are considered basic, or alkaline.

pH Color Chart



Source: National Aeronautics & Space Administration

OBSERVE
- Examine the physical properties of the liquids on the table and record your observations.
- Use the "wafting method" (move your hand back and forth over the top of the container) to determine how each liquid sample smells.
- Describe the color, viscosity (Is it runny or thick? How easily does it flow?), and other physical properties of the liquid samples.

Physical Properties of Liquids

	SMELL	COLOR	VISCOSITY	OTHER
Distilled water				
Lemon juice				
Vinegar				
Baking soda & water				

PREDICT

Predict the pH of each liquid sample. Is it an acid, a base (alkaline) or neutral? Record your predictions in the chart found in the PROCEDURE section.

PROCEDURE

1. Test each liquid sample by dropping one pH tablet into the test tube.
2. After the tablet has dissolved, compare the liquid sample in each test tube with the ph Color Chart above.
3. Record your observations on the chart below.

pH Levels

	pH Prediction *(write the number)*	**pH Results**	**Acid, Base or Neutral?**
Distilled water			
Lemon juice			
Vinegar			
Baking soda & water			

Part 2: pH and Plants

GET READY!

You will now place seeds in each solution to observe how pH levels affect seed germination (growth).

PREDICT

Predict what effect each solution will have on the seeds. Record your predictions.

Seed Growth Predictions

Solution	**Prediction**
Vinegar Water	
Baking Soda Water	
Plain Water	

PROCEDURE

You will place seeds in each solution to observe how pH levels affect germination (growth).

1. Label the plastic storage bags vinegar/water solution, baking soda/water solution, and plain tap water using the permanent marker.
2. Next, place a paper towel onto each of the three plates.
3. Count out eight seeds and place them on the paper towel in each of the plates.
4. Pour plain tap water onto one plate of seeds, filling the plate half-way.
5. Place the plate into the matching plastic storage bag and seal the bag securely.
6. Repeat the process, pouring the vinegar/water solution onto one plate of seeds, and the baking soda/water solution onto the remaining plate of seeds. Save the remaining solutions in a sealed container.
7. Place each plate into the matching plastic storage bag and seal each bag securely.
8. Put the seed plates near, but not directly under, a light source.
9. Check the seeds in a few days to see if any of them are germinating (growing).
10. Check the seeds every week and measure the growth of any sprouts using a centimeter ruler.
11. Keep the paper towels moist by refilling the solutions as needed – don't let the seeds dry out.

OBSERVE

Record and share your observations with your partner or group.

Seed Germination

	Measure in centimeters (cm)	____ Days	____ Days	____ Days	____ Days
Vinegar/ water					
Baking soda/water					
Plain water					

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION
What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION
What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Word Pun

He studied water purification and had a great thirst for knowledge.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Repeat Part 1 of this investigation using other materials such as salt, milk, apple juice, hydrogen peroxide, shampoo, soda and soapy water. Record your results.
- Design an experiment to test the effects of other pollutants on aquatic ecosystems. What would happen if an ecosystem had too much salt, for example?
- Draw a diagram showing where acid rain and other pollutants travel through the environment.
- Collect water samples from an aquarium or from local bodies of water and test their pH levels. What can these levels tell you about the organisms living in these environments?
- Look at the shampoo bottles at home or in the store. Why does the pH level of shampoo or the pH level in a pool need to be a certain level?
- Plant the sprouted seeds from this investigation and chart their growth.

Science @ Home!

Make a Natural pH Indicator

The pH (potential hydrogen) level measures the strength of a chemical. pH is measured on a scale from 1 to 14 and tells how much hydrogen is found in a particular substance. Hydrogen is a naturally-occurring element and is one of the building blocks of Earth. You may remember that two hydrogen atoms combine with one oxygen atom to form a molecule of water. Hydrogen is found in all living things. The amount of hydrogen makes a solution acidic or basic. If you've ever used vinegar or baking soda, you're already familiar with acid-base chemistry. Ask an adult to help you make a natural pH indicator.

Materials

- Sliced red cabbage
- Stainless steel pan or microwave baking dish
- 1 quart water
- Stove, microwave, or hotplate
- White vinegar
- Baking soda
- Clear fruit juice or other beverage (non-carbonated)
- 3 clear cups or glasses
- Measuring spoons and measuring cups
- 4 teaspoons for stirring

Procedure

1. Boil the cabbage in a covered pan for 30 minutes or microwave in a bowl for 10 minutes.
   Note: Do not let the water boil away, or evaporate.
2. Let the cabbage cool before removing it.
3. Pour about ¼ cup of cabbage juice into each cup.
4. Add ½ teaspoon of baking soda to one cup and stir with a clean plastic spoon.
5. Add ½ teaspoon vinegar to second cup and stir with a clean spoon.
6. Add 1 teaspoon of clear non-carbonated beverage to the last cup and stir with a clean spoon.
7. Pour the contents of the vinegar cup into the baking soda cup.

Observe

- What color change took place when you added vinegar to the cabbage juice? Why?
- Did the baking soda turn the cabbage juice pH indicator red or blue? Why?
- What happens to the color if you pour the contents of the vinegar cup into the baking soda cup?
- If you were to gradually add vinegar to the cup containing the baking soda and cabbage juice, what do you think would happen to the color of the indicator? Try it, stirring constantly.
- Is the non-cola soft drink an acid or a base?

Explanation

The vinegar and cabbage juice mixture should change from deep purple to red, indicating that vinegar is an acid. The baking soda and cabbage juice mixture should change from deep purple to blue, because baking soda is a base which reacts chemically with the pH indicator, turning it blue. You should find that the acid and base are neutralized, changing the color from blue or red to purple -- the original color of the cabbage juice. As vinegar is added, the acid level increases, turning the cabbage juice pH indicator red.

Source: http://www.epa.gov/docs/acidrain/education/experiment3.html

Investigation: To Drink or Not to Drink?

OBJECTIVE
In this investigation, you will work in groups to find a way to clean a polluted water sample.

Part 1: Pollution Solution
You can use any of the materials on the table to develop a method to remove the pollutants from your water sample.

OBSERVE
- Make observations about the dirty water sample. How does it look? Smell? Remember to use the wafting method to draw the odors towards your nose.
- Look at the materials that you can choose from to clean your water sample.

PREDICT
Will your group be able to clean the polluted water sample? Record your prediction.

PROCEDURE
Try to clean your dirty water sample. Share and document your group's methods. Which materials did you use to try to clean your water sample? How well did they work?

Part 2: Make it Clean, Make it Safe

GET READY!
In this part of the investigation, you will learn how water is cleaned at water treatment plants.

PROCEDURE
1. Set aside the dirty water sample from Part 1.
2. Using a funnel, pour half of the 2-liter dirty water sample into the 2-liter bottle with a cap.
3. Place the cap on the bottle and shake it for 30 seconds.
4. Next, pour the water into another 2 liter plastic bottle using the funnel, and pour the water back and forth between the bottles approximately 10 to 15 times.
5. Once the gases have escaped (the bubbles will stop forming), pour the water into the bottle with its top cut off.
6. Add two tablespoons of alum powder to the water and slowly stir the mixture.
7. Slowly stir the mixture for 3 - 5 minutes.

OBSERVE

Let the water sit undisturbed in the container for 5 minutes, then make observations about the water sample for the next 10 minutes. Record your observations every two minutes in the chart provided.

Observations of Dirty Water With Alum Added

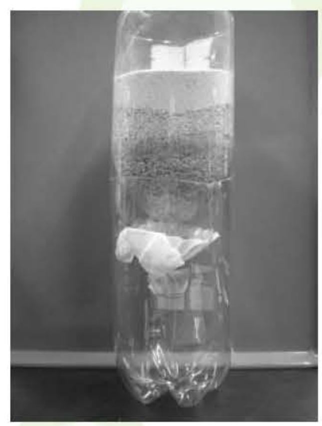
Intervals	Observations
2 minutes	
4 minutes	
6 minutes	
8 minutes	
10 minutes	

After ten minutes think abouth these two questions:
- How does the water sample look now?
- How do you think adding a substance such as alum makes it easier to purify (clean) dirty water?

Part 3: Make a Water Filter

In this part of the investigation, you will construct a filter using the bottle with no bottom.

PROCEDURE



1. Using a rubber band, attach the coffee filter to the outside neck of the bottle with the bottom cut off.
2. Place the bottle neck-side down into the cut-off bottom of a two liter bottle, which will serve to catch the filtered water.
3. Pour a layer of pebbles into the bottle with the bottom cut off. **NOTE: The coffee filter will prevent the pebbles from falling out of the neck of the bottle.**
4. Pour the coarse sand on top of the pebbles.
5. Pour the fine sand on top of the coarse sand.
6. Slowly and carefully pour 2 liters of clean tap water through the filter to rinse it. Try not to disturb the top layer of sand as you pour the water.
7. Discard the tap water that collects in the catcher after it has gone through the filter and then replace the catcher to its original position.
8. After a large amount of **sediment** has settled to the bottom of the dirty water sample to which the alum powder was added, carefully pour the cleaner top part of the dirty water sample (without the clumps) through the filter so that it collects in the catcher.
9. After the dirty water has gone through the filter completely, set aside the catcher containing the filtered water.
10. Also set aside the portion of the dirty water sample that was not poured through the filter, so that you can compare it to the filtered sample.

OBSERVE

Make observations about the filtered and unfiltered water samples. Share your observations with your partner or group.

- How has the filtration process changed your dirty water sample?

- Is your water sample safe for drinking? Bathing? Cooking?

SAFETY TIP
THE WATER THAT YOU JUST FILTERED IS NOT SAFE TO DRINK. Water treatment plants add disinfectants to the water to purify it and kill any organisms that may be harmful. Disinfectants are strong chemicals, so we are not using them in this investigation.

WRAP-UP

It is important to share results so that everyone has a clear picture of what happened. Scientists learn from each other through discussion and build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their investigations, we will now come together as a group to make conclusions in this wrap-up part of the lesson.

GROUP DISCUSSION
What did you learn from the group discussion? Did everyone have the same results? Did someone have a different opinion than you?

REFLECTION
What are your own ideas about this investigation? What new things did you learn? What surprised you? Record any thoughts that you might have.

Curriculum Match-Up

Here are some additional activities you can do to enhance what you learned in this investigation.

- Get a map of your state or town and chart the pollution in the area using colored pins.
- Find out which methods are used to clean the water in your area.
- Contact programs in your state that monitor and assess water quality. Visit http://yosemite.www.epa.gov/water to learn more.
- Adopt a watershed in your state to protect and restore rivers, estuaries and wetlands in your area.

Science @ Home!

Edible Aquifer

An aquifer is an underground source of water. When rain and other forms of precipitation fall to Earth, water soaks far into the ground and travels between the tiny particles of soil and rock underground. These tiny particles act as a filter, purifying water naturally.

Materials

- Blue or red food coloring
- Vanilla ice cream
- Clear soda
- Chocolate chips, multiple sizes
- Cake decoration sprinkles and sugars
- Drinking straws
- Spoons
- Clear cups

Procedure

1. Fill a small, clear cup about one-third of the way with chocolate chips. This represents all of the sand, gravel, and rocks in an underground aquifer.
2. Now, cover the "gravel, sand, and rock layer" with clear soda. This is the groundwater. Observe how the "water" fills in the spaces around the "gravel, sand, and rock".
3. The next layer of the aquifer is called the confining layer, which is usually clay or dense rock. The water is cramped below this layer. Spread a layer of ice cream over the chips and soda to represent the confining layer. Now add another layer of "gravel and sand", chocolate chips.
4. The next layer is the porous, spongy top layer of soil. Use decorating sprinkles and colored sugar to represent this layer.
5. Add a few drops of food coloring to a small amount of soda. The coloring represents pollution. Can you think of some pollutants that can affect groundwater?
6. Pour the soda over the layers of land. What do you observe?
7. Suck on the straw to pump the well and watch as the "water table" goes down.
8. Next, push the straw down toward the bottom of the cup into the center of your aquifer. This represents a drill trying to reach the water. Slowly begin to pump the well by sucking on the straw.
9. Make observations as the "water table" goes down. Are any contaminants seeping into the well area?
10. Recharge the aquifer by adding more soda. This represents "rain".

Explanation

Many communities and homeowners must rely on wells that pump groundwater from aquifers. Unfortunately, groundwater can be contaminated by improper use or disposal of harmful chemicals, such as lawn fertilizers and household cleaners. These chemicals can percolate (seep into) down through the soil and rock into an aquifer and eventually be drawn into the wells. Water contamination poses a significant threat to human health.

Source: http://www.dnr.state.wi.us/org/caer/ce/eek/cool/ameliaedibleaquifer.htm (modified)

21st Century Community Learning Centers Programs

Soaring Beyond Expectations

NJDOE