

# THE WATERSHED TOUR™

## WELCOME

Code 5419

**WARNING:** This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

### SYMBOL LEGEND



Signals interesting facts, hints or ideas.



Signals optional enrichment activities for each unit.



Reminds instructors when handouts should be distributed.



Alerts teacher that this section is for the instructor and not a part of the lecture. It may note an entire page or a single step.

**BOLD phrase**

Bold phrases in the text are answers to questions posed to the students or helpful comments which supplement the procedures.



Indicates where students are to draw on a handout.



Waiting time during tests - an opportunity to reinforce text material.



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The goal of the Watershed Tour is to introduce students to stream and river ecosystems through a classroom-based tour of a virtual watershed. The Watershed Tour will provide a hands-on experience through which students will learn about stream ecology, water quality, and how their own actions can affect a watershed.

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## **REAL SCIENCE**

The procedures used in the Watershed Tour are simplified, but similar, to those used by scientists throughout the world. The methods do not require sophisticated apparatus or equipment and can be explained in simple scientific terms. They are never interpreted as magic tricks.

Students will become familiar with the concepts that:

- ◆ water is a vital natural resource
- ◆ everyone lives in a watershed and interacts with the watershed
- ◆ human and natural influences affect streams

Active participation in the Tour involves the processes of:

**Observing • Comparing • Organizing and Classifying  
Predicting • Analyzing and Summarizing •  
Communicating**

The Watershed Tour is divided into 6 units. The activities in each unit introduce new skills and reinforce the skills learned in the previous unit. The test procedures include “waiting time” that can be used to reinforce the short lessons and games included in the Tour.

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**UNIT 1 INTRODUCTION**

- Discussion: Everyone Lives In A Watershed
- Activity: Watershed Fill In the Blanks
- Discussion: The Water Cycle
- Discussion: Water Use
- Handout: Water Facts
- Game: The Watershed Maze

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**UNIT 2 MAPS AND SITE DESCRIPTIONS**

- Discussion: Topographic Maps
- Activity: Identify the Big River Watershed
- Activity: Site Descriptions
- Game: Big River Criss-Cross Puzzle

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**UNIT 3 HABITAT**

- Discussion: Habitats and Ecosystems
- Activity: Stream Survey
- Game: Habitat Word Search Game

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**UNIT 4 WATER CHEMISTRY**

- Discussion: Water can dissolve all kinds of stuff
- Game: Land Use Matching Game
- Discussion: Water Quality Factors
- Handout: pH Scale
- Activity: Testing Water Samples

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**UNIT 5 BIOLOGY**

- Discussion: Life in Stream Habitats
- Discussion: Aquatic Macroinvertebrates
- Activity: The Critter Card Game
- Discussion: The Food Chain
- Game: The Food Chain Game

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**UNIT 6 CONCLUSION**

- Discussion: Conclusion
- Activity: Site Conclusion Sheet
- Discussion: Summary
- Game: On the Way to the Bay Game

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**APPENDIX A • VOCABULARY**

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**APPENDIX B • ADDITIONAL RESOURCES**

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**APPENDIX C • WATERSHED TOUR CHEMISTRY**

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**APPENDIX D • REFILL AND REPLACEMENT PARTS LIST**

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# **TEACHER TIPS** **PREPARATION**

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## **PREPARATION**

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Read the instructions ahead of time to familiarize yourself with the procedures and concepts of each unit.

## **SHOPPING LIST & MATERIALS CHECK LISTS**

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Be sure to have everything on hand before it is needed. Encourage students to “recycle/reuse” plastic soda or milk bottles by washing them and bringing them into class for this project. You will need 14 bottles.

## **RECORD KEEPING**

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Have students make folders with a Watershed theme to store their handouts and data sheets. Display the Color Chart Poster and the Classroom Data Poster as part of a bulletin board display.

# **ORGANIZING THE TOUR**

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## **ORGANIZATION**

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The Watershed Tour is designed for four groups of students to evaluate simulated water samples from one of four mystery sites within the virtual watershed. Students will gather chemical and biological data throughout the Tour that will allow them to determine the identity of their site at the conclusion of the Tour. The Watershed Tour is designed to be presented directly to your class as a lecture/lab activity.

## **GENERAL PREPARATION**

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Use the shopping list provided on page 6 to gather materials. It contains all of the items needed for your entire Watershed Tour.

## **PREPARE FOR EACH UNIT**

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Review the materials check list provided at the beginning of each unit. It contains the items necessary for that unit of the Watershed Tour.

- Make copies of handouts and data sheets for each student.
- Prepare solutions for the chemistry unit.
- Copy and cut thermometers for the chemistry unit.
- Copy and cut cards for the Food Chain Game.
- Copy and cut the Critter cards.
- Copy and cut cards for the On The Way To The Bay game.

To save paper or if a copier is not conveniently located, maps, data sheets, etc. may be laminated or put in sheet protectors and used with dry erase markers. Handouts can be copied onto overhead sheets and used with an overhead projector. The Critter cards, game boards and cards can be laminated.

To make organization quicker, color code sample containers, handouts, etc. for each site - red, yellow, blue or green. Use colored stickers, colored tape or label them with colored markers.

# UNIT 1 - INTRODUCTION

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◆ indicates a classroom discussion or activity.

□ indicates a handout.

## UNIT OBJECTIVES

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Students will be able to:

- label and define the parts of a watershed
- describe the water cycle
- explain water use and the importance of conserving water

## UNIT OUTLINE AND MATERIALS CHECK LIST

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- Hang Up: the Big River Watershed Poster (one per classroom)
- ◆ Discussion: Everyone Lives In A Watershed
- Handout: Watershed Fill-In the Blanks (#1) (one per student)
- ◆ Activity: Watershed Fill In the Blanks
- ◆ Discussion: The Water Cycle
- Handout: The Water Cycle (#2) (one per student)
- ◆ Discussion: Water Use
- Handout: Water Facts (#3) (one per student)
- Handout: The Watershed Maze (#4) (one per student)
- ◆ Game: The Watershed Maze
- ◆ Big Beef Up Activity #1: Optional Unit Enrichment : Vocabulary Bingo.

## UNIT VOCABULARY

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condensation	polluted
ecosystem	precipitation
evaporation	reservoir
groundwater	source
headwaters	tributary
hydroelectric	watershed
mouth	

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# EVERYONE LIVES IN A WATERSHED

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HANG UP: Big River Watershed Poster (Poster A)



**Activity #1:**  
Vocabulary Bingo,  
pg. 21.

All of the water on the planet is constantly moving from one location to the next. It is easy to see this when you look at rainwater washing down the street or at a mighty river. Most rivers start as small streams. These are called the **headwaters** of the river. The beginning of a river is also called the **source**. The water at the source might come bubbling up from an underground spring or, in high and cold regions, the water can come from melting snow and ice. Some of the water soaks into the ground and some flows over the land, but all of it flows downhill as it enters a stream. When it rains, the rainwater collects and finds its way into the stream, too. Small streams flow together to create bigger streams. These streams get larger and turn into rivers, which join together to create even bigger rivers. A small stream that flows into a larger river is called a **tributary**. The rivers flow downhill across the land until they eventually reach the sea. The end of the river, where it flows into another body of water is called the **mouth** of the river.



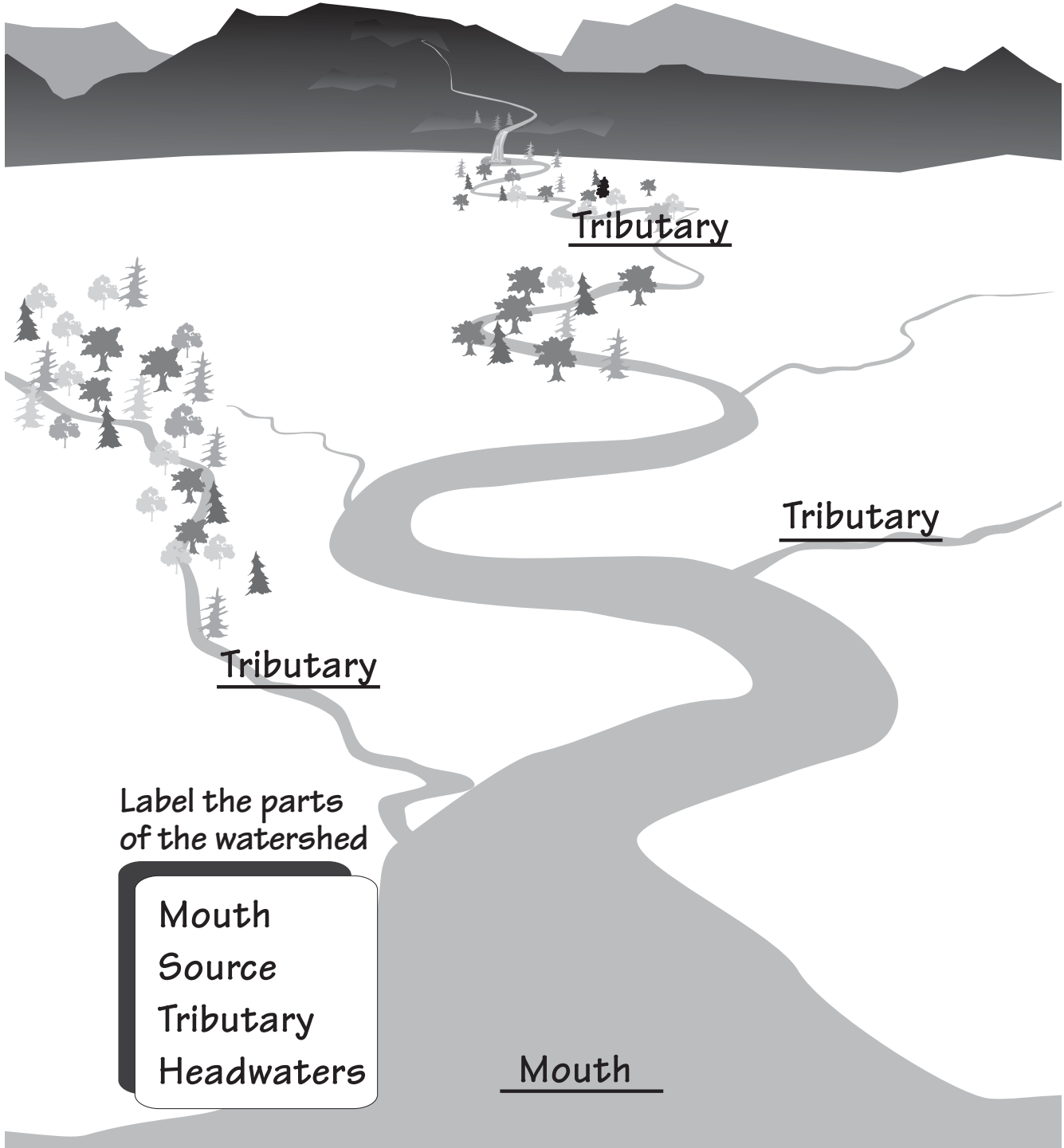
HANDOUT: Watershed Fill-In The Blanks (#1)

The area of land over which the water traveled to reach the mouth of the river is called the **watershed**. Watersheds can be big or small, have mountains or be almost flat.

Depending on where you live, all of these names can be used to describe a flowing water **ecosystem** that is contained in a watershed: stream, river, brook, creek, rill, run, branch, race, arroyo, or fork. They are all correct. In the Watershed Tour we will refer to the smaller flowing water ecosystems as streams and the larger ones as rivers.

# THE WATERSHED

Source OR Headwaters




## **SITE DESCRIPTIONS**

Students will become familiar with four sampling sites on the Big River watershed which they will be studying throughout the rest of the Tour.

The students will listen while they look at their Big River Site Maps which are enlargements of the sites on the Big River Watershed map.

- At each bullet, read the description and have students listen.

 At each pencil, read the description and have the students draw or write a description of what they hear on their Big River Site Maps.

Don't read the underlined words. Wait for the student's response. Let them "fill in the blank."

You may want students to close their eyes and listen to the last sentence in each description.



## PINE CREEK



Soil high up in the mountains is thin. A thin layer of soil with underlying granite rock does not **buffer** acid rain.



Pine Creek is a small stream that flows through a forest of **deciduous** oak and maple trees and some pine trees. The trees shade the stream. Draw another tree shading the stream.



The cold, clear water splashes over the rocks of a waterfall and fallen logs as it tumbles down from the mountain sides. Draw more cold water splashing over the rocks. People taking a sample here would probably get their feet wet.

- In some areas, the water is moving very quickly over the rocky stream bottom. In other parts of the stream, the water collects in deep areas that appear to be still. Of course the water isn't still, it's always continuing downhill to eventually join the Big River.



On the shore, roots of trees grow over the rocks and along the banks of the stream. Draw some tree roots holding together the stream bank.



Leaves from the trees become food for the animals in the stream. Draw a leaf in the stream and some moss on the log.



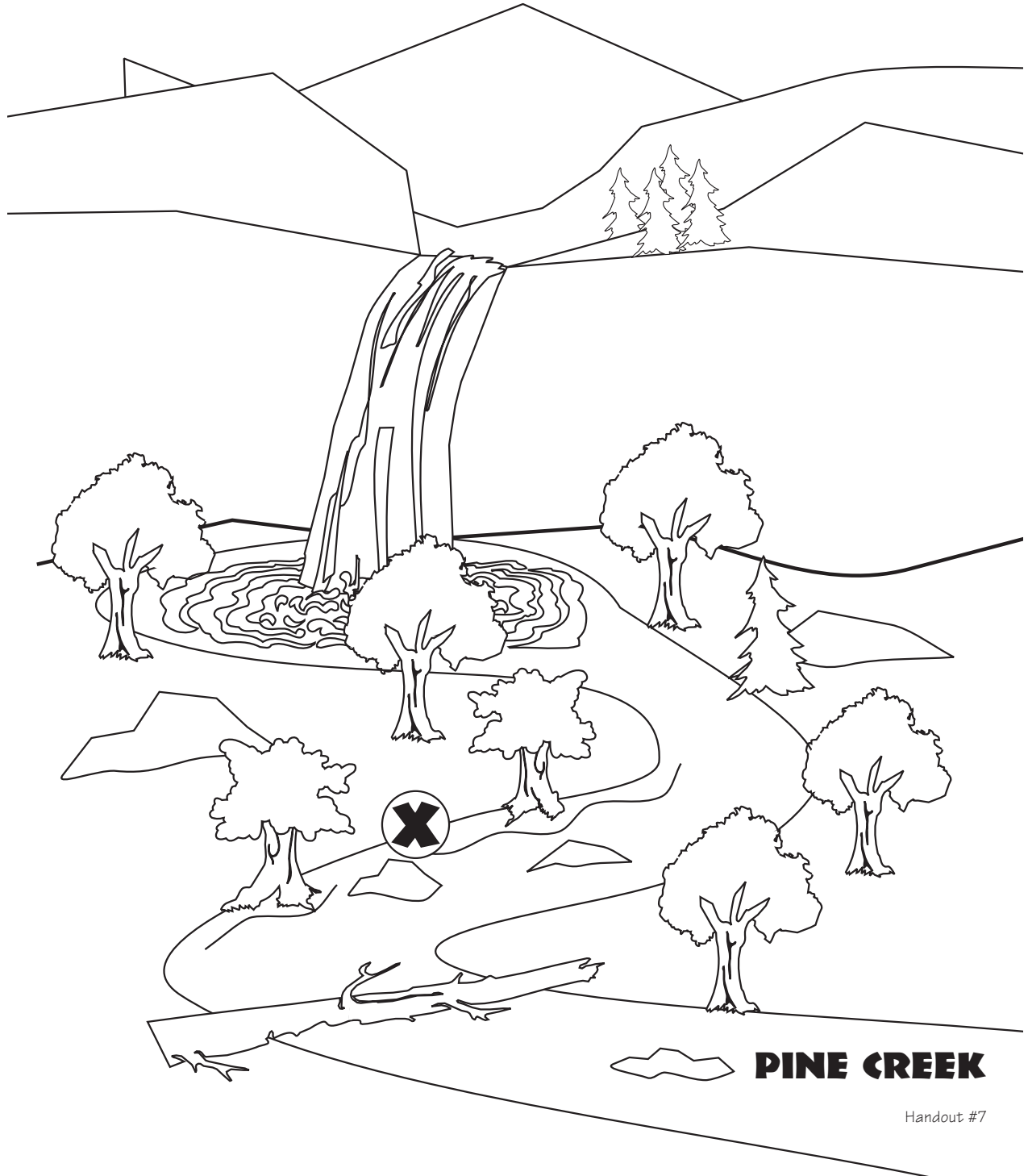
Fish and other living things find habitats under fallen trees or rocks in and along the stream. Find a habitat where a fish could find food and shelter. Draw a fish.



Draw an arrow to show the direction that the water is flowing.

- Listen: If you are quiet, you can hear the songs of birds mingle with the sound of the swiftly flowing water of Pine Creek.

# PINE CREEK SITE





◆ indicates a classroom discussion or activity.

□ indicates a handout.



Review the safety information on page 9.

### UNIT OBJECTIVES

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Students will be able to:

- list substances that can be dissolved by water
- perform chemical tests
- collect data
- discuss land use effects on water quality

### UNIT OUTLINE AND MATERIALS CHECK LIST

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- ◆ Discussion: Water can dissolve all kinds of stuff
- Hang up: Classroom Data Sheet
- Handout: Field Notebook Page (#19) (one per team)
- Handout: Team Data Sheet (#20) (one per team)
- Handout: Land-Use Matching Game (#21) (one per student)
- Hang up: Watershed Color Chart Poster
- ◆ Game: Land-Use Matching Game
- Handout: Water Samples (four per group)
- ◆ Discussion: Dissolved Oxygen
- Handout: Dissolved Oxygen Testabs (2 per team) and vial (1 per team)
- ◆ Activity: Dissolved Oxygen Procedure
- ◆ Discussion: pH
- Handout: pH Scale (#22)
- Handout: pH Wide Range Testab (1 per team) and tube (1 per team)
- ◆ Activity: pH Procedure
- ◆ Discussion: Nitrate
- Handout: Nitrate WR Testab (1 per team) and test tube (1 per team)
- ◆ Activity: Nitrate Procedure
- ◆ Discussion: Salinity
- Handout: Chloride Testabs (1 per team) and test tube (1 per team)
- ◆ Activity: Salinity Procedure
- ◆ Discussion: Temperature

*continued*



## pH

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pH is the negative log of the hydrogen ion concentration.

$$\text{pH} = -\log[\text{H}^+]$$

For every one unit change on the pH scale, there is a ten-fold change in the acidity or basicity of the sample.

The pH test is one of the most common tests done in water testing. A pH measurement is a measurement of relative acidity. It is based on the activity of the hydrogen ions in the water. The pH scale ranges from 0 to 14. Water samples with a pH below 7 are acidic, those above 7 are basic and those with a pH of exactly 7 are considered to be neutral.

In nature, the pH of water is influenced by the type of rocks and soil that it flows around and flows through. Water that reacts with **alkaline** soils and minerals will have a pH of 8.0 to 8.5. Rapidly growing algae and vegetation remove carbon dioxide ( $\text{CO}_2$ ) from the water during photosynthesis which also causes pH levels to rise.



HANDOUT: pH Scale (#22)

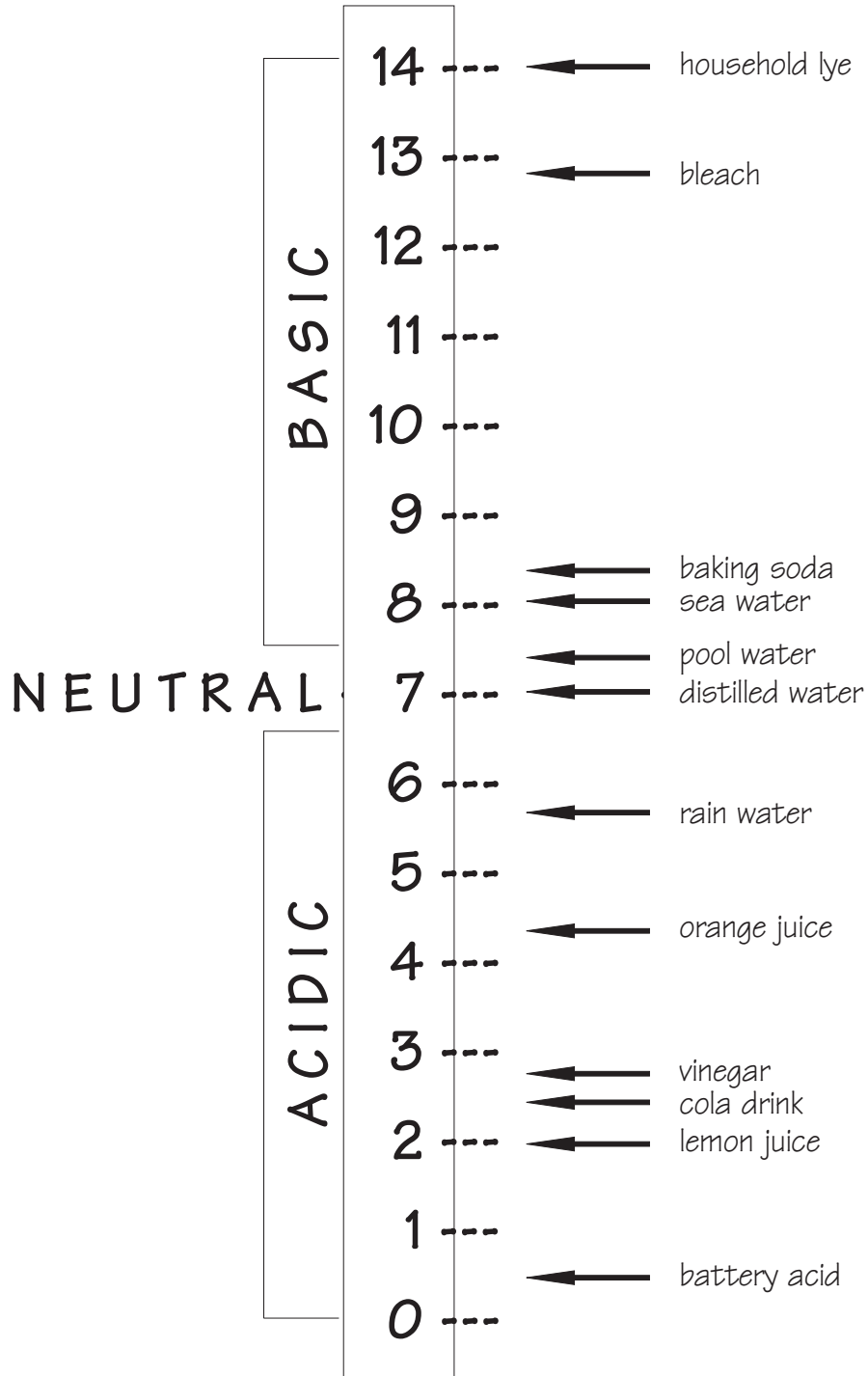
Look on the pH Scale to find the pH of some common household items. Notice that sea water has a pH close to 8.0 and acidic, freshly fallen rainwater may have a pH value of 5.5 to 6.0.

pH can be affected by industrial waste, agricultural runoff or drainage from improperly run mining operations.

The optimum pH for most organisms is between 6.0 and 8.5. Some organisms may die if the pH is even slightly out of this range.

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# PH SCALE



## pH PROCEDURE

**WARNING:** This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

1. Fill a tall, plastic test tube (O106) to the 10 mL line with the pH sample.

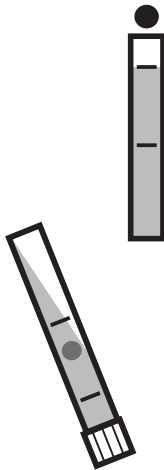
HINT: Hold the tube over an empty cup, bucket or sink to catch any drips. An eye dropper can be used to adjust the water level in the tube so that it is right on the line.



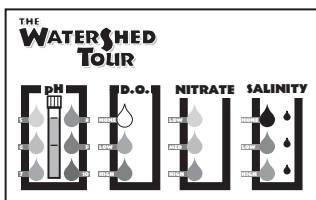
2. Add one pH Wide Range TesTab (6459).

3. Cap the tube and mix until the tablet has disintegrated.

HINT: Mix the sample by inverting the tube over and over so that the tablet slowly moves from one end of the tube to the other.



4. Hold the tube against the white area of the Watershed Tour Color Chart Poster (5419-CC). Compare the color of the sample in the tube to the pH Color Chart.



5. Record the pH result on your Group Data Sheet.

6. Record the pH result on the Classroom Data Sheet.



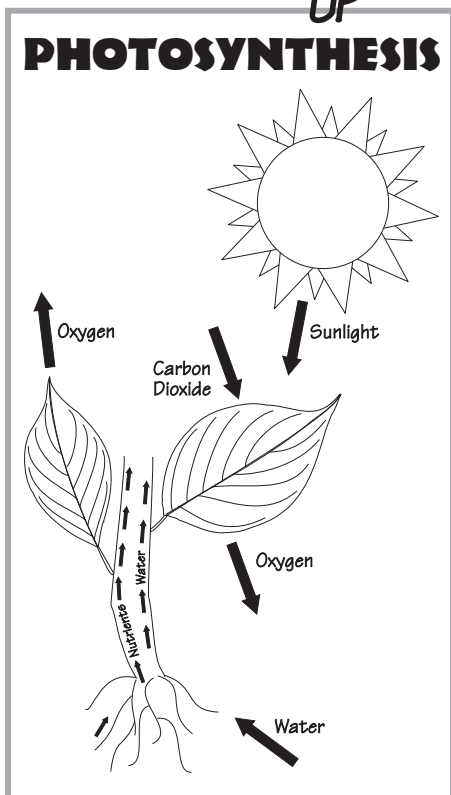
## THE FOOD CHAIN

The wide variety of organisms that live in a stream are linked by their feeding relationships called a food chain. The living things in a stream ecosystem can be classified as producers, consumers or decomposers.

**Producers** use nonliving materials to make their own food. Plants and algae, through a process called **photosynthesis**, use carbon dioxide and water in the presence of sunlight to produce food.

Animals that feed on the producers are called **consumers**. All animals are consumers because they eat, or consume, something. They rely on other living things for food. Some consumers, like mayflies, eat algae that grows in streams. Other consumers, like crane flies, depend on leaves that fall into the stream. The leaves come from trees which are producers that grow on the land. Consumers that eat plants are called **herbivores**. Some consumers, called **predators** or **carnivores**, eat other animals. These include dragonflies, fish and birds. Many animals eat both plants and animals and are called **omnivores**.

Eventually, all living things die and become food for another kind of consumer called **decomposers**. Fungus and bacteria are examples of **decomposers**.



HANDOUT: Food Chain Cards (#29-#34)  
Food Chain Game Guide (#35)

# FOOD CHAIN GAME CARDS

TREE LEAVES 	TREE LEAVES 	TINY PLANT PIECES 	TINY PLANT PIECES 
TREE LEAVES 	TREE LEAVES 	TINY PLANT PIECES 	TINY PLANT PIECES 
TREE LEAVES 	TREE LEAVES 	TINY PLANT PIECES 	TINY PLANT PIECES 
TREE LEAVES 	FISH 	TINY PLANT PIECES 	BACTERIA 

CRANEFLY 	MAYFLY 	DRAGONFLY 	MIDGE 
CRANEFLY 	MAYFLY 	BACTERIA 	MIDGE 
CRANEFLY 	MAYFLY 	TINY PLANT PIECES 	MIDGE 
TREE LEAVES 	TREE LEAVES 	TINY PLANT PIECES 	ALGAE 

# **APPENDIX A**

## **VOCABULARY**

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These are words that will be used throughout the Watershed Tour. Many will already be familiar to you and your students.

<b>AEROBIC</b>	requires oxygen to live
<b>ALGAE</b>	aquatic one-celled or multi-celled plants
<b>ALKALINE</b>	having a pH of more than 7
<b>AMPHIBIANS</b>	a class of cold blooded animals like toads and frogs
<b>BANK</b>	where a stream or river meets the land
<b>BUFFER</b>	a substance capable of neutralizing acid or bases maintaining the initial pH or a protective vegetative border around a body of water
<b>CARNIVORES</b>	consumers that eat animals
<b>CONDENSATION</b>	the process by which a gas becomes a liquid
<b>CONSUMER</b>	a living organism that eats other organisms for food
<b>CONTOUR INTERVAL</b>	the change in elevation between contour lines on a topographic map
<b>CONTOUR LINE</b>	line on a topographic map that show equal elevation
<b>CRUSTACEANS</b>	a class of mostly aquatic animals that includes lobsters, shrimp, crayfish and crabs
<b>DECIDUOUS</b>	trees that seasonally lose their leaves
<b>DECOMPOSITION</b>	to undergo a chemical or physical breakdown
<b>DECOMPOSERS</b>	consumers that eat dead stuff