Water, Water, Here and There

Water, Water, Here and There

Adapted from Schaumburg Illinois School District 54 Science Curriculum
"Small Things"

Teacher's Guide

Developed by:
Diane Highlander, Judy Maxson, Kim Niemietz,
Carol Norris, and Leslie Piork

Piloted by:
Donna Carli, Michael Davies, Rebecca Keim, and Neil Wyatt

Edited by:
Michael Schneider

M.A.S.H.
Math **A**nd **S**cience **H**ands-On

A Science Literacy Project

Funded By:
Illinois State Board of Education

Sponsored By:
Regional offices of Education
Southern Illinois University Edwardsville

ESC Project Team:		**SIUE Project Team:**	
Director:	Michael Schneider	Director:	Dr. David Winnett
Coordinator:	Kathy Derango	Coordinator:	Ann Scates
Consultants:	Barbara Goldenherseh	Specialist:	Dr. Virginia Bryan
	Dr. Andrea Williams	Consultants:	Dr. William P. Ahlbrand
	Joan Barrett		Dr. Lela DeToye
			Dr. Thomas Jewett
			Dr. Robert Williams

In Cooperation with Regional Superintendents

The Honorable Harry Briggs, Jr.	Madison County
The Honorable Faye Hughes	Monroe/Randolph Counties
The Honorable Russell Masinelli	Macoupin County
The Honorable Martha O'Malley	St. Clair County
The Honorable Larry Wolfe	Clinton/Washington Counties

Water, Water, Here and There
Supplies List

Item	Quantity
10 Gallon Container	1
Aluminum Pie Pans 9"	10
**Aluminum Foil	1 roll
Aquarium Gravel	1 bag
Aquarium Square 1 gallon	8
*Coffee Filter	50
**Dishsoap, Dawn	1
*Flour	1
**Food Coloring Assorted Colors	1 box
Game Card (F) 5 sheets	1
*Kool-Aid (unsweetened grape)	1
**Lentils	1 pound
**Lima Beans (baby)	1 pound
Marbles	40
Medicine Cups	10
Assorted Netting	6
*Paper Clips, Regular	1 box
Pennies	15
**Pinto Beans	1 pound
Pipettes	1
Plastic Glasses, Clear, 9 oz.	10
Plastic Tubing - Aquarium	4
Plasti-Clay	1 pound
Puzzle Pieces (30 - 50)	1
**Rice	1 bag
Rubber bands	15
Salt	2 boxes
Scientific Encounters of the Mysterious Sea	1
**Sidewalk Chalk	2
**Straight Pins	1 box
*Straw Stirrers	100
*String	1 roll
*Sugar	1 pound
Teaching Guide	1
Thumbtacks	15
Transparencies	2
*Toothpicks (round)	1 box
Twist Ties	15
Wire, Thin (30 guage)	1

*Consumable **These items are consumable after a number of uses.

Water, Water, Here and There

Table of Contents

M.A.S.H. at a Glance

Introduction

This section is written to provide you with a quick overview of the major curriculum elements around which the M.A.S.H. Kits are designed. The acronym M.A.S.H. represents Math And Science Hands-on. M.A.S.H. Kits were developed through a cooperative effort among local school districts, Educational Service Center Region 16, and Southern Illinois University at Edwardsville and originated from a regional Title II Science Cooperative. Funding by the Illinois State Board of Education through a Science Literacy Grant provided development, piloting, and revision of these kits, designed to meet the needs of teachers wanting to teach activity-based science in southwestern Illinois. Specifically, these needs were identified as: availability and cost of materials, lack of time needed to teach science inquiry, and teachers' limited background in science. The thrust of development focused on these needs. The key elements of the M.A.S.H. Kit program are: scope and sequence of fundamental science concepts, alignment with state goals, emphasis on science process skills, cooperative learning, integration of language arts, opportunity to apply mathematics skills in real problem solving situations, teacher ownership, and alternatives in assessment. Special recognition should be given to the exemplary science kit program from Schaumburg Illinois School District 54, for their initial assistance and ideas.

Scope & Sequence

Each kit is developed around a fundamental theme in science that can be matched to concepts covered in most textbooks. Students explore these central themes as they complete approximately ten developmentally appropriate, process-based activities. The primary sequence introduces a theme from life, physical, or earth science. The intermediate kits further develop these same themes. Middle school kits continue to reinforce these same basic themes while utilizing a higher level of technology.

State Goals

The M.A.S.H. Kits were developed by Illinois educators primarily to assist classroom teachers in meeting the educational needs of their students. As a result, each investigation's instructional objectives focus upon the Illinois State Goals for Learning. These goals include the basic concepts and fundamental skills in science, mathematics, social studies, language arts, fine arts, health, and physical education. Each investigation has been carefully selected to prepare students to meet or exceed Illinois goals. At the beginning of each of the activities the specific goals and objectives addressed by that activity have been identified and referenced.

Science Process Skills

The activities in the kits address the science process skills necessary for students to utilize when learning science: observe, measure, classify, infer, predict, communicate, formulate hypothesis, experiment, and interpret data.

Cooperative Learning

The instructional approach utilized in this curriculum is one of having students work in cooperative groups. It is recommended that the size of your cooperative groups not exceed four students. Many educational benefits occur when students work together in groups to investigate and solve problems. Cooperative learning more closely resembles the way individuals work together to solve problems in the real world. Another important reason for the use of cooperative groups is to make the acquisition, costs, and management of materials reasonable for the classroom teacher.

Language Arts

Students read about, talk about, and write about the exciting science activities they are doing. This additional use of language along with the science investigation, reinforces the students' understanding of the scientific principles being explored. Not only do many of the kits include their own science-related books, but an additional list of resources is located in the introduction of each kit guide.

Mathematics

Many of the science investigations result in an opportunity for the students to apply mathematics skills in a variety of ways. Students are encouraged to quantify their observations with metric measurements; record and report those same observations with charts, tables, and graphs. Often times students will need to apply mathematical operations to solve problems or answer questions.

Alternatives in Assessment

The Unit Test provided in this guide can be used to determine students' understanding of the major concepts dealt with in the kit. Unit Tests use a variety of different questions such as multiple choice, fill in the blank, short answer, etc. The Unit Test may be given in a pre-post type format to determine: 1) the increase of students' understanding as a result of this unit and 2) clarify students' prior skills and knowledge to determine the direction instruction should take. Kits also include a performance based assessment that gives teachers the opportunity to observe what students actually can do with the science concepts and skills they have learned.

Teacher Ownership

The success of this program has been strongly dependent upon teacher ownership, especially at the very beginning of the projects' early stages of developing, piloting, and editing of the core activities. Continued teacher ownership has resulted in the creation of extension activities which provide additional instructional opportunities in all curricular areas. These extensions continue to be developed by classroom teachers using the M.A.S.H. kits. Materials for these activities may or may not be included in the kit. If you have a great extension idea for a kit activity, please send it to us at Southern Illinois University Edwardsville, Box 2226, Edwardsville, IL, 62026.

Water, Water, Here and There

Major Purpose

Three quarters of the Earth's surface is covered with water. Some of it is a bright, clear blue, and some is a dark greenish black. Some of the water is salty; other is fresh. Sharks live in some bodies of water, while goldfish swim in others. What makes these bodies of water different? Why are they divided?

Water, Water, Here and There will make the wonderful world of water come alive for your students. By mixing fresh and saltwater together, dropping objects into water, and identifying mixtures and solutions, students learn "hands-on" about the aquatic environment. Whether your students want to be marine biologists, or just like to swim, your students will benefit from *Water, Water, Here and There*!

Objectives

After completing *Water, Water, Here and There*, a student will be able to:

Generally:

- use charts to present and compare scientific information
- measure using the metric system
- organize and complete experiments according to the steps of the scientific method, focusing on their ability to predict behavior, collect data, compare information, and draw conclusions
- graph
- compute averages using decimals
- use a scientific key to correctly interpret charts and graphs
- work effectively and efficiently in small groups and pairs

Specifically:

- identify mixtures and solutions and make samples of each
- explain the concepts of density and buoyancy
- understand sonic depth sounding
- define those words specific to study and communicate the science of water such as estuaries, solution, surface tension, and habitat

Teacher Background Information

1. Throughout this kit, you are using a large amount of water. It is a good idea to have some type of gallon containers available to carry water. These are NOT included in the kit.
2. A journal would be ideal to use with this kit. Each day new discoveries and ideas should be recorded. This would give each student a study guide and resource book.
3. Game cards for *Water, Water, Here, and There* need to be prepared in advance.
4. The final activity, Whale of a Tail, requires a research unit on whale, preferably done in small groups, prior to this activity. We have included some basic information in the kit, but additional research may be needed.

These safety rules may be discussed and posted during science activities or the teacher may have the class generate a list of safety procedures to follow.

SAFETY POSTER:

1. Always wear proper eye and clothing protection.
2. Work only with materials that have been approved and provided by your teacher. Never take chemicals or equipment from the supply shelf yourself.
3. Never perform an experiment your teacher has not reviewed and given you permission to perform.
4. Do not use any equipment that is not working properly or is unsafe for any reason. Report faulty or damaged equipment to your teacher.
5. Tie back long hair. Confine all loose clothing.
6. Always be careful when handling chemicals. Immediately wash chemicals off your skin with water. Carefully clean up any spills.
7. Never put any equipment in or near your mouth or eyes. Never eat or drink while in the science area.
8. Do not taste anything during an experiment unless the teacher tells you that it is safe.
9. Clean up work area and return all materials to their proper place.
10. Always be careful when handling sharp objects such as scissors, mirrors, compasses, pins, tacks, and paper clips.
11. Speak quietly in groups so that directions can be heard.
12. Immediately inform your teacher of any accidents.

SAFETY LESSON

OBJECTIVES:

1. The students will name the safety rules that apply in the classroom.
2. The students will describe appropriate safety procedures through the construction of safety posters.

MATERIALS:

Pencils
Posterboard or oak tag
Overhead Projector
Crayons/markers
Safety transparency

PROCEDURE:

1. This should be the introductory lesson for the kit. The lesson should begin with a focus on the classroom safety procedures. Brainstorm for do's and don'ts for science activities. Record these ideas on the chalkboard. Be sure that the list includes the following:
    - Handle all science materials carefully (particularly sharp objects).
    - Always walk in the science area.
    - Keep all science materials out of your mouth.
    - Notify teacher immediately if ANY injury occurs.
    - Apply pressure to cuts.
    - Keep sharp objects away from faces.
    - Carry no more than two items at a time.
2. Review the safety poster and provide examples of safe and unsafe behaviors. Then have students determine whether the behavior is safe or unsafe and why.
3. Ask students how they might add to the list of safety rules when the topic of study is water. Record their ideas on the chalkboard. Establish Classroom Safety Rules. Students should then make a list to keep in their notebooks.
4. Have students make posters that illustrate these safety rules, both general rules and one's that apply specifically to this unit of study.

FORMATIVE EVALUATION:

1. Students will be evaluated on their participation in the class discussion.
2. Students will be evaluated on the basis of content, originality, and neatness.
3. Students will be evaluated on the basis of their list of classroom safety rules.

LANGUAGE ARTS EXTENSION: The students will write an essay explaining their safety rules and the reasons behind them. This could be kept as part of an ongoing journal or notebook.

Cooperative Learning: Classroom Management Techniques

1. In order for your students to complete the activities successfully, it is essential that they know, and follow, the ten rules for group work:
    - Move into groups quietly, without bothering others
    - Use quiet voices
    - Stay with your group
    - Everyone does a job
    - Everyone shares the work
    - No one is bossy
    - Everyone shares materials
    - Everyone shares ideas
    - Take turns talking
    - Care about others' feelings

2. Initially avoid competition between groups. This can be accomplished by carefully selecting groups in a variety of manners — randomly (i.e. by birthdays), by students' abilities, or by allowing the students to choose groups for themselves. It is important to note that if the final technique is used to form groups, the students must be made aware that if their group does not perform adequately or productively, alternative selection methods will be employed (i.e. teacher selection).

3. Clearly define the task to be done.

4. Be sure there is a "product" connected with the group activity.

5. In setting time limits, allow too little time rather than too much time for the group to finish.

6. Each person in the team should play an active role. Regular rotation of roles should occur to give each student the opportunity to play a different role. Roles students can have are:

Principal Investigator:	This person keeps the group members on task, makes sure the activity is understood by all and is completed. Any questions will be immediately clarified with the teacher.
Materials Manager:	This person obtains all supplies the group needs. If the group is large enough, a second Materials Manager can be assigned to be responsible for returning materials to the supply area and having the group clean up its work area.
Recorder/ Evaluator:	This person writes down responses that team members have formulated. This person notes how well group members perform their responsibilities, contributing to the overall performance and outcome of the group.
Reporter:	This person writes down the group's conclusions and reports to the class. The reporter may also need to record the group's data on a class graph or chart. If the group is large enough, two Reporters can be assigned — one to record conclusions and chart data, the other to present their findings to the class.

7. Follow the Five C's of Group work to have a safe, and FUN, science activity:

Caution:	Laboratory group work requires caution in every part. Safety instructions should be followed and a safety checklist should be implemented before each activity.
Cooperate:	To insure successful group work, each member must cooperate with the other members of the group.
Contribute:	Each member must make an effort to contribute something to the group.
Control:	Group work requires control over our body movements, voices, and actions. To avoid chaos in the classroom, control must be practiced by each member of the group.
Clean-Up:	Each group member must do his, her, or their own part to clean up after the activity. Students must make sure the work area is clean and all materials are put away.

8. The culmination of a group activity should be a time of sharing and evaluating how well group members worked together as well as examining the groups' end results or products.

Water, Water, Here and There

Resource List

Literature

Aquatic Project Wild. Western Region Environmental Education Council. 1987.

Journeys in Science (5th grade edition). Shymansky, J.A.; Romance, Nancy; Youre, Larry. MacMillan Publishing Company: New York, 1988.

Living in Water. National Aquarium: Baltimore (National Science Foundation Grant #MDR 8470190). 1987.

Science Discovery Activities Kit. The Center for Applied Research in Education. Simon and Schuster: New York, 1989.

Whale Adoption Project. Chase, Dr. Valerie. International Wildlife Coalition: North Falmouth, Massachusetts, 1989.

Supplementary Materials

The Voyage of the Mimi. Sunburst Communications: New York.

The Second Voyage of the Mimi. Sunburst Communications: New York.

Children's Books

Amazing Creatures of the Sea. National Wildlife Federation, 1987.

The Crab on the Seashore. Coldrey, Jennifer. Stevens, 1987.

Exploring the Seashore. Amos, William H. National Geographic Society, 1984.

The Man-of-War at Sea. Shale, David; Coldrey, Jennifer. Stevens, 1987.

Nature Hide-and-Seek--Oceans. Wood, John Norris. Knopf, 1987.

The Rock Pool. Bellamy, David. Clarkson N. Potter Inc., 1988.

The Sea Is Calling Me. Hopkins, Lee Bennett (editor). Harcourt, Brace, Jovanovich, 1986.

The Seashore. Pope, Joyce. Watts, 1985.

Strange Animals of the Sea. National Geographic Society, 1987.

The World of Crabs. Coldrey, Jennifer. Stevens, 1987.

The World's Oceans. Sandak, Cass R. Watts, 1987.

Water, Water, Here and There

ACTIVITY #1: Making and Separating Mixtures and Solutions

OBJECTIVES: (These will be addressed in Activities 1-3).

1. The students will identify a mixture as a combination of substances that: do not combine chemically and can be separated without chemical change.
2. The students will identify a solution as a combination of substances that: mix evenly, are transparent, and will not separate when filtered.
3. The students will make samples of mixtures and solutions.
4. The students will explore ways of separating mixtures and solutions.

MATERIALS:

Pebbles
Clear plastic cups
Salt
Stirrer
Medicine cups
Student activity sheet

TEACHER/STUDENT PROVIDED MATERIALS:

Paper towels
Saucer or jar lid
Tweezers - optional

PROCEDURE:

1. Divide students into cooperative learning groups of 3-5. Each student should receive an activity sheet. One person in the group should gather the rest of the supplies.
2. Have students add 5 ml. of pebbles and 10 ml. of salt in a container and mix. What happens? Can the two things be separated? Students are to record all observations on the activity sheet.
3. Remind the students to save their pebbles and salt on a sheet of paper off to one side.
4. Mix 20 ml. of pebbles and 30 ml. of water together. Can they be separated? How?
5. Combine the 10 ml. of salt (use the salt from step #2) and 30 ml. of water. What can be observed? How can they be separated?
6. Mix the 10 ml. of pebbles, salt, and water. Can these be separated?
7. Define mixture and solution. Have students discuss how this activity demonstrated both.

FORMATIVE EVALUATION:

1. Students will be evaluated on their ability to work in groups.
2. Students will be evaluated on their activity sheets.

LANGUAGE ARTS EXTENSION: Students will start a journal and write conclusions they made based on their observations.

MATH EXTENSION: The student measures the salt, pebbles, and water using the metric scale found on the medicine cups.

Name _____

Student Activity Sheet:

Mixing and Separating Mixtures and Solutions

Directions: Make the combinations of substances listed below. Describe how some substances can be separated without using a chemical change. Use clean pebbles, salt, and water for each experiment.

MIX	OBSERVATIONS	HOW CAN THEY BE SEPARATED?
Pebbles and Salt		
Pebbles and Water		
Salt and Water		
Pebbles, Salt, and Water		

ACTIVITY #2: To Be or Not To Be A Mixture

TIME: 30 - 45 Minutes

OBJECTIVE:

1. The students will define and list the properties of a mixture.
2. The students will demonstrate their ability to make sample mixtures.

MATERIALS:
Flour
Water
Clear plastic cups
Coffee filter
Medicine cups

TEACHER/STUDENT PROVIDED MATERIALS:
Rubber bands to hold filters in place

PROCEDURE:

1. Divide students into cooperative learning groups of 3-5. Distribute materials. The following instructions are per group.
2. Have the students predict whether combining flour and water will be a mixture or a solution.
3. Have students mix 10 ml. of the flour and 90 ml. of the water in clear plastic cups.
4. Using knowledge gained from the previous lesson, ask students to determine whether or not it is a mixture.
5. Students should observe what happens as the flour begins to settle. Add to the previous definition of a mixture the following properties:
    - Does not mix evenly
    - Is not transparent
    - Will separate when filtered.
6. Ask students again if they think it is a mixture. They should be able to defend their answers.
7. Have the students pour the flour/water through a filter - it separates, thus it is a mixture.
8. Ask students to predict other things that might combine to form a mixture. These ideas could be included in their notebooks or journals for later verification or experimentation.

LANGUAGE ARTS: Students will record their observations in their journals.

MATH EXTENSION: The students will measure the flour and water using the metric scale.

ACTIVITY #3: To Be or Not To Be A Solution

OBJECTIVE: The students will identify a solution as a combination of substances that: mix evenly, are transparent, and will not separate when filtered.

MATERIALS:

Poster (teacher or student made, showing the 3 properties of a mixture and a solution - see above and previous lesson)
Sugar
Medicine cups
Clear plastic cups
3 coffee filters
Powdered drink mix (Kool Aid)
Straw stirrers

TEACHER/STUDENT PROVIDED MATERIALS:

Large clear container of water

PROCEDURE:

1. Divide students into cooperative learning groups of 3-5.
2. Explain that the students will conduct their own experiment to apply the safety rules.
3. Review the definition of a mixture and introduce the definition of solution. Direct the students attention to the poster.
4. Have each group pour 50 ml. of warm water into a jar. Add 7 ml. of sugar and stir until it dissolves.
5. Ask the students to observe what happened to the sugar (it disappeared).
6. Have the students make predictions - Can the substance be separated? What happens when we try to filter it?
7. Have the students pour the substance through the filter. Students should observe and record their observations. There should be no sugar in the filter because the sugar has formed a solution with the water. All 3 properties of a solution should be present.
8. Direct students attention to the poster again. These steps can be combined to determine whether or not something is a mixture or a solution.
9. Repeat the experiment substituting 1 ml. of Kool Aid mix for the sugar. The results should be the same. NOTE: THE FILTER MAY BECOME STAINED FROM THE KOOL AID, BUT THIS DOES NOT INDICATE A SEPARATION BETWEEN IT AND THE WATER.
10. Using this newly acquired knowledge, have students generate a list of things they think are solutions. Compare this to the previous list of mixtures. Have students research their predictions and write up their findings.

LANGUAGE ARTS EXTENSION: Students will record their observations in their journals.

MATH EXTENSION: Students should be estimating measurements of sugar and Kool Aid using the metric scale.

ACTIVITY #4: Sink or Float? Float or Sink?

TIME: 30 - 45 Minutes

OBJECTIVE:

1. The students will demonstrate the knowledge of density and buoyancy.
2. The students will be able to make predictions about the density and buoyancy of an object, and record their results on a data sheet.

MATERIALS (per group):

Gallon aquarium
Salt
Aluminum foil - 15 cm x 15 cm
Data sheet

TEACHER/STUDENT PROVIDED MATERIALS:

Water
Egg - raw or hard-boiled
Small piece of crayon
Quarter
Sheet of newspaper

NOTE: The hard-boiled egg may be substituted, as well as the quarter.

PROCEDURE:

Experiment #1: Density and Fresh Water

1. Divide students into cooperative learning groups of 3-5 and distribute materials.
2. Students should record the information on the data sheet as they complete each step.
3. Make predictions about whether the egg, crayon, and quarter will sink or float when placed in the glass of water.
4. Spread newspaper over the work area. Test each object, one at a time, by carefully placing the object in the water.
5. Conclusion: Density is the amount of matter (mass) an object contains for each unity of its volume. Objects sink or float depending on their density. An object whose density is greater than water, such as the egg or quarter, will sink. An object whose density is less than water, such as the crayon, will float. (A bottle of pennies is denser than a bottle of feathers, it weighs more even though it takes up the same amount of space.)

Experiment #2: Density and Salt Water

1. Add salt (about one handful) to the container of water.
2. Predict whether the egg, crayon, and quarter will sink or float when placed in the glass of saltwater.
3. Then test each object by placing it in the water.
4. Conclusion: Saltwater is denser than freshwater. Although the eggs are denser than the freshwater, it is not as dense as the saltwater. Therefore, the egg floats. Almost everything floats more easily in saltwater.

Experiment #3: Density, Displacement, and Buoyancy

1. Fold the foil so that it is in the shape of an open box.
2. Put the box on the surface of the saltwater. Place the quarter on the box gently. Observe.
3. Take the box and the coin out of the water. Tightly wrap the quarter inside the foil. Place it on the surface of the saltwater - gently. Observe.
4. Conclusion: The more water the object displaces, the more buoyant it becomes. An object that covers a greater surface of the water (the quarter in the foil box) is more buoyant than the compact object (the quarter wrapped tightly in the foil) because it displaces more water. This phenomenon enables large ships made of dense steel to float.

FORMATIVE EVALUATION:

1. Students will complete the experiments and determine which objects are able to sink or float.
2. Students will be able to make inferences due to their knowledge of density and buoyancy.
3. Students will complete the data sheets and share the results of their experiments.

Water, Water, Here and There

Name _____

Student Activity Sheet: Sink or Float?

Experiment #1: Complete the chart below. First predict whether each object will sink or float when placed in a glass of water. Then test each prediction. Record the result.

	PREDICTION	RESULT
EGGS		
CRAYON		
QUARTER		

If an object is denser than water, it will sink. Which objects are denser than water?

_____

Experiment #2: Complete the chart below. Predict whether each object will sink or float when placed in a glass of saltwater. Test each prediction. Then record the result. Use the results to write sentences that prove this statement: Saltwater is denser than freshwater.

_____

_____

_____

_____

	PREDICTION	RESULT
EGGS		
CRAYON		
QUARTER		

Water, Water, Here and There

Experiment #3:

What happens when you place the quarter in the foil box on the water?

_____

What happens when you place the quarter wrapped in foil on the water?

_____

The foil and the quarter weighed the same in both instances. Why do you think the results were different?

_____

_____

_____

_____

_____

_____

_____

_____

ACTIVITY #5: The Layered Look - (Teacher Demonstration)

TIME: 30 - 45 Minutes

OBJECTIVE:

1. Students will be able to describe and explain the distribution of salt and fresh water in an estuary.
2. Students will observe and draw inferences from the demonstration.
3. Students will be able to predict where the saltiest water would exist in the mouth of a river.

MATERIALS:

Several markers or crayons
2 - 1 gallon clear plastic containers
2 siphons (plastic tubing)
1 labeled gallon of clear freshwater
1 labeled gallon of saltwater (one cup salt per gallon) with 8 drops of food coloring
Student Activity Sheet

PROCEDURE:

1. This activity works best as a demonstration. Plan a spot where all of the children will have a clear view.
2. Define the term estuary (a semi-enclosed body of water where incoming seawater is diluted with freshwater coming from land). Ask the students to predict what might happen when freshwater and saltwater meet.
3. Pour some of the clear water into one of the containers. Into the other container, pour some of the colored saltwater. Demonstrate by siphoning the colored saltwater into the clear water. Be careful to keep the siphon close to the bottom of the container. CAUTION: Do not let the students shake or move the surface on which the containers rest.
4. Have students observe from the SIDE, not the top.
5. Question the students:
   A. How many layers are formed? (two)
   B. Which layer is salty? (bottom)
   C. Which layer is fresh? (top)
   D. Are they completely separate? (no)
   E. What is happening between the two layers? (interfacing)
   F. What would happen if one tested the salinity at different levels in an estuary? (Salinity would increase with depth)
6. Students should record their observations on data sheets.
7. Conclusion: Because salty water is denser than freshwater, it sinks below the freshwater when the two come in contact.

FORMATIVE EVALUATION: Students will be evaluated on their data sheets.

Adapted from Life in Water.

Water, Water, Here and There

Name _____

Student Activity Sheet: The Layered Look

State the question you are trying to answer by observing this demonstration.

_____

_____

_____

_____

_____

_____

Draw the results of the demonstration here:

First tank or jar Second tank or jar

Based on the results of this demonstration, where would you expect to find the saltiest water if you were studying the mouth of a river where it formed an estuary as it meets the ocean? The top of the water or the bottom?

_____

_____

_____

_____

_____

_____

_____

_____

Water, Water, Here and There

Name _____

"Possible Answers"
THE LAYERED LOOK

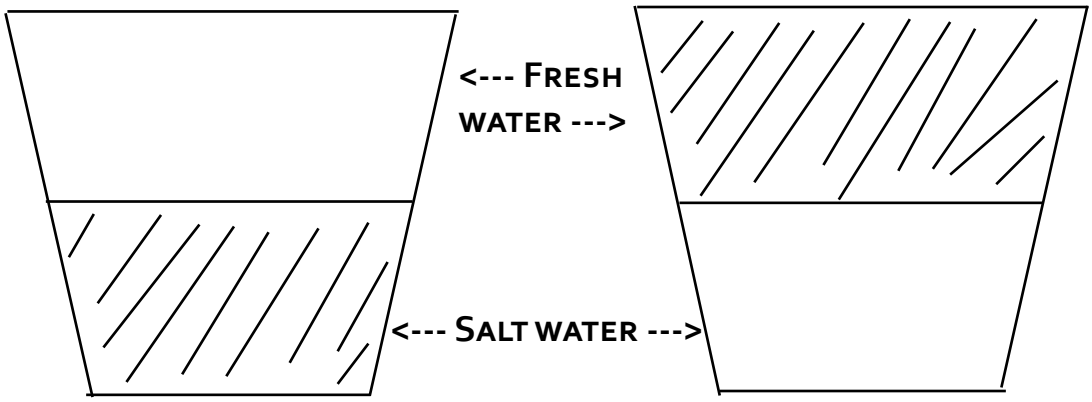
State the question you are trying to answer by observing this demonstration.

What happens when saltwater and freshwater are gently added to each other? What might happen where a river meets the sea?

Draw the results of the demonstration here:

First tank or jar

Second tank or jar



Based on the results of this demonstration, where would you expect to find the saltiest water if you were studying the mouth of a river where it formed an estuary as it meets the ocean? The top of the water or the bottom?

I would expect the saltwater to be on the bottom. If the water were mixed, maybe by the wind, the two kinds of water might mix as it did when John kept bumping the table.

ACTIVITY #6: Life at the Surface

TIME: 30 - 45 Minutes

OBJECTIVE:

1. Students will be able to observe and demonstrate the existence of surface tension.
2. Students will be able to create a model of a living organism from simple materials.
3. Students will practice predicting, graphing, and averaging skills.

MATERIALS:

Clear plastic cup
2 paperclips
1 small foil pie tin
20 marbles
1 container of water (more than enough to fill the cup)
Dishwashing detergent

MATERIALS FOR MAKING MODEL ANIMALS:

Toothpicks
Think wire
String
Straight pins
Clay
Staples
Plastic coffee stirrers
Plastic strawberry baskets
1 activity sheet per student

PROCEDURE:

1. Divide the class into cooperative groups of 3-5.
2. Have students put water into the clear cup until it appears to be full. They should observe that the water level is up to the top of the cup. Ask if they believe that the cup is full.
3. Have them estimate how many marbles they could add to the cup before it overflows.
4. Students should drop the marbles into the cup one at a time, counting as they drop.
5. Students are to observe and count until the water bulge appears to break and the water comes over the side of the cup.
6. Write the numbers for each group on the chalkboard and then have each student plot on their data sheet.
7. Add the numbers from each group and calculate an average.
8. Discuss what happened. The water molecules are attracted to each other; they stick together. At the surface this produces a film that covers the surface and holds it. It is called SURFACE TENSION. When the film broke, the water fell over the sides.
9. Have students predict how strong the surface is. Would a paperclip sink? Try it. It does not float because it is heavier than water.
10. Demonstrate how the paperclip rides the surface. Show that it is not floating because it sinks if touched. Try adding some detergent with the pipette. The clip should sink as the detergent destroys the surface tension.

11. Discuss how animals make use of surface tension. Some kinds of beetles and bugs walk on the water in search of their prey. Some pond bugs have special hairs that form dimples on the water surface. Others have a spring-like appendage with which the jump around on the surface of the water.
12. Challenge the students to create the heaviest insect model that can stay on the surface of the water.
13. Show the creations and demonstrate their use of surface tension.
14. Weigh them in some manner and determine the heaviest.
15. Complete the data sheets and discuss.

FORMATIVE EVALUATION:

1. The students will be evaluated on the completion of their data sheets.
2. The students will be evaluated on the insect model and its use of surface tension.

Adapted from Life in Water.

Water, Water, Here and There

Name _____

Student Activity Sheet: Life at the Surface

1. How many marbles do you predict will be added to the glass before the water runs over?

   _____

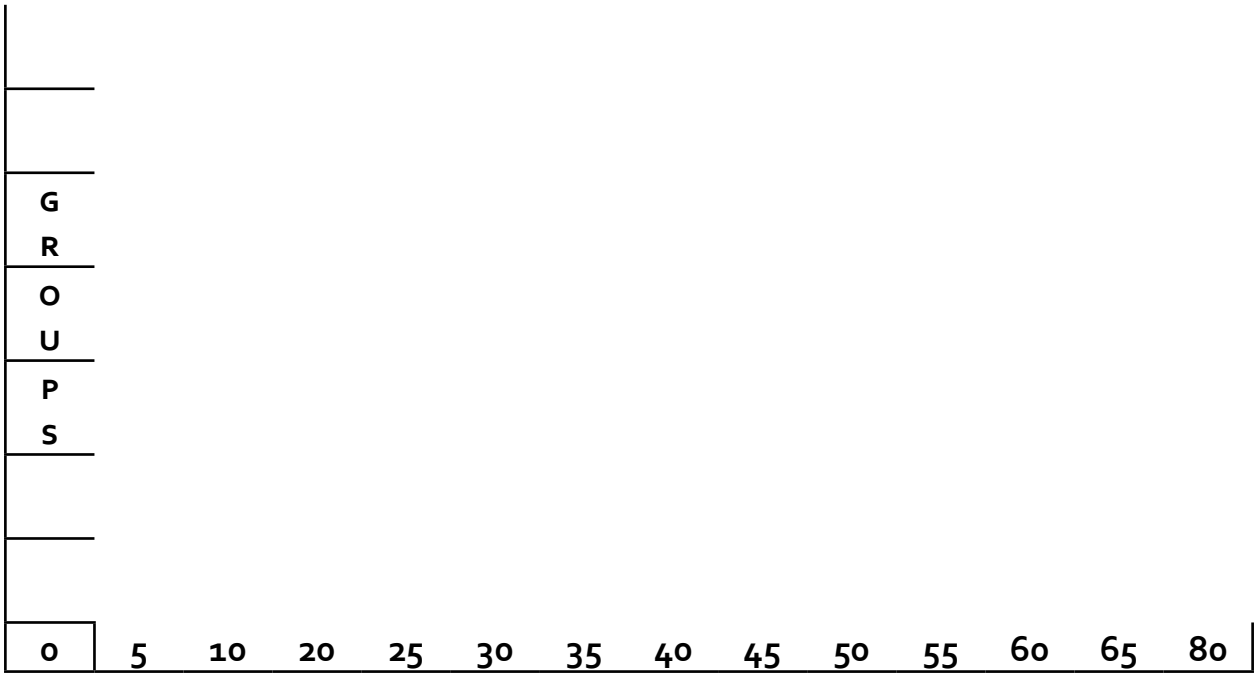
2. How many did you actually add?

   _____

3. What happened when you added marbles to a full glass of water?

   _____

PLOT THE NUMBER OF MARBLES ADDED BEFORE THE WATER RAN OVER



4. What is the average of these number? _____

5. How did this compare with your estimate?

   _____

6. Did you succeed in making the paperclip ride on the surface tension?

   _____

7. What happened when detergent was added?

   _____

8. On the back of this sheet, draw a model on your surface tension "rider".

ACTIVITY #7: Water, Water Everywhere

TIME: 30 - 45 Minutes

OBJECTIVE:

1. The students will be able to classify different types of aquatic habitats.
2. The students will learn to use a flow chart and/or a scientific key.

MATERIALS:

1 Transparency of the habitat flow chart
30 duplicates of the habitat cards (1 per student)
30 copies of the flow chart
30 copies of the scientific key

TEACHER BACKGROUND INFORMATION: There are duplicates in the set of habitat card. You may want to make sure the cards are distributed to children so that those who sit near another do not receive the same card.

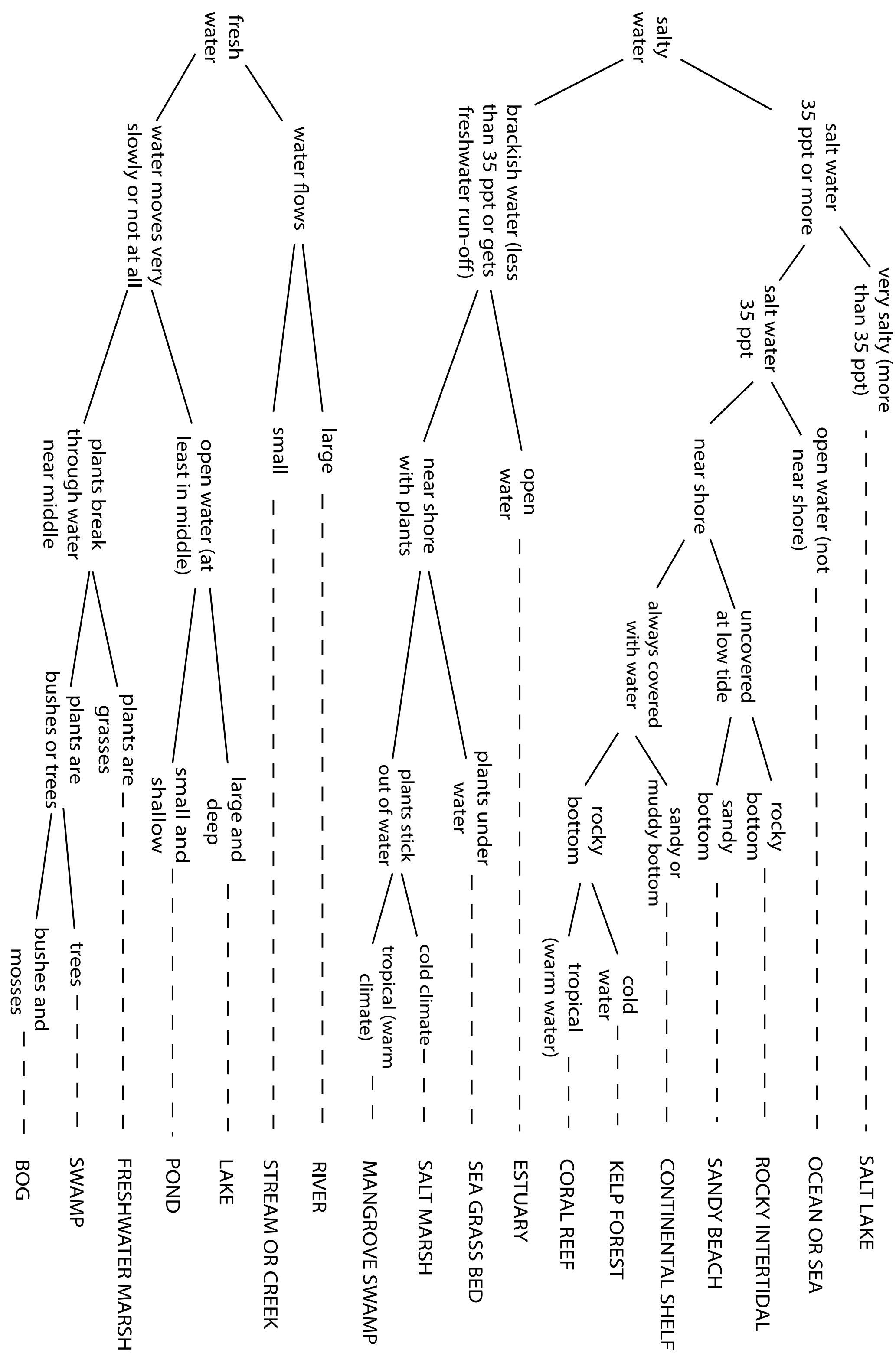
PROCEDURE:

1. Explain CLASSIFICATION. Relate to how things are named and then placed into larger groups of things that share similar characteristics. For example, many kinds of tables are lumped under the term table as are many kinds under chairs. Both tables and chairs belong to a larger category, furniture. This could possibly be diagrammed on the board.
2. Introduce the terms SALTWATER, BRACKISH WATER (somewhat salty), AND FRESHWATER.
3. Review the term HABITAT.
4. Distribute cards and challenge the students to discover what kind of habitat is represented on their cards.
5. Demonstrate using the flow chart at each stage to divide characteristics until no further division is possible. This is their aquatic habitat.
6. Each student then attempts to use the flow chart to identify his or her habitat.
7. Check the students results as they work.
8. Trade cards to keep the activity going.
9. Show the scientific key and discuss its differences. Demonstrate the use of the key.
10. Allow the students time to identify habitats by using the key.
11. Verify results of students' classifications by using the teacher's answers provided.

FORMATIVE EVALUATION: Students will be evaluated on their ability to use a flow chart to identify a habitat.

LANGUAGE ARTS EXTENSION: After the children have identified their habitats, have them write a few paragraphs telling what it would be like to live in that aquatic habitat.

WATER, WATER, HERE AND THERE



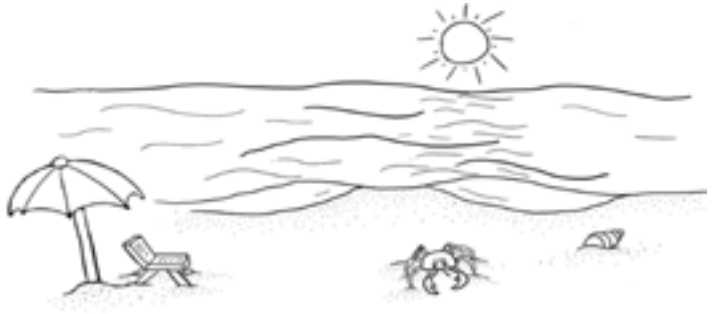
AQUATIC HABITAT CARDS: A

Bushes and mosses grow in your shallow, still water. Patches of very wet ground are home to pitcher plants which get their nutrients from the insects they catch in their leaves. Your water is fresh, but very acidic.

You are _____

You have salt water that rises and falls with the tides. Sometimes the waves roll way up on your sand while at other times much of your sand is not covered with water. Children play on you. When a storm comes, your sand is moved all around.

You are _____

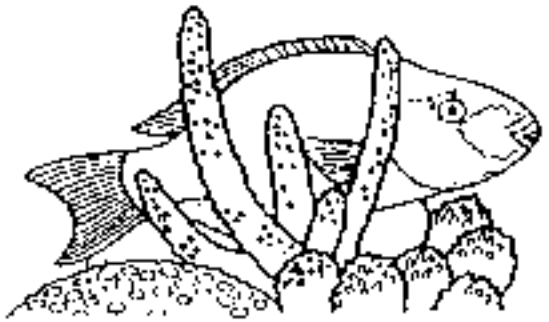


Your sandy or muddy bottom is under salt water. In some places the water is deep, but you are along the shore. Animals burrow in your sand or mud. Your water is rich in tiny plants which provide food for many animals. Fisherman harvest your animals.

You are _____

Your warm, salt water and rocky bottom provide the perfect place for animals called corals to grow. Their skeletons make a great place for fish to live. Because you are in a place that is warm all year-round, you are a tropical habitat. Tourists swim out from the beach to visit you.

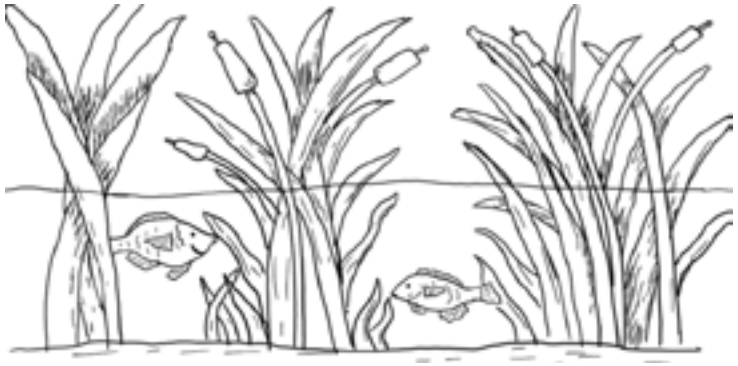
You are _____



AQUATIC HABITAT CARDS: B

You thrive in cool, shallow, and salty water close to shore. You provide food and shelter for fishes, invertebrates, and marine mammals. The plants protect the nearby shore from erosion because they break the force of the waves.

You are _____



The big roots hold the trees in the mud, even when hurricanes disturb your constant warm days. Many animals and plants find a home on your tree roots or in your waters. Because it is warm all year-round, you are said to be a tropical habitat.

You are _____

Your fresh water tumbles down over rocks and through small pools where fish and crayfish hide. Your water comes from rain that runs off the land and from springs that bring underground water to the surface.

You are _____

Sun shines through your shallow, open, fresh water, allowing underwater plants to grow on the bottom. Still and small, you may freeze solid where winters are cold. In the summer turtles bask on your shore and deer drink from you.

You are _____

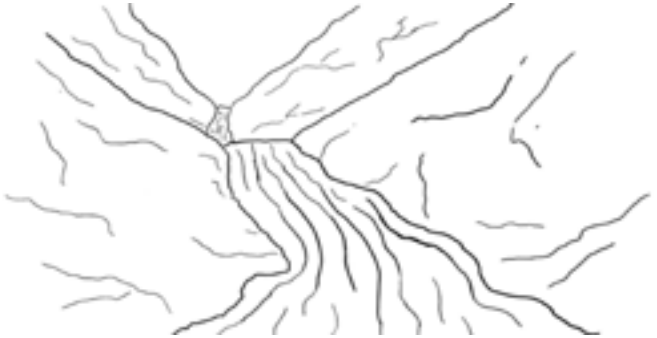
AQUATIC HABITAT CARDS: C

The tides flood and drain your deep mud every day, providing habitat for sea grass. Each winter, the sea grass die, but by the spring they come back. The decaying grass participles are food for crabs and oysters. The grasses protect the shore from storms.

You are _____

Your canals collect and drain precipitation, surface runoff, and naturally stored water of glaciers and snowpack. Hundreds and thousands of years ago, people built towns and cities along your banks because your waterways provided an efficient route to move goods through trade.

You are _____



Your quiet, fresh waters are home to many fishes which hide deep beneath your surface. Storms may make waves on your wide surface. Where winters are very cold, you may be covered with ice.

You are _____

Grasses grow out of your still, fresh waters. Red-winged blackbirds build nests in the grasses. The air is filled with the calls of the male blackbirds.

You are _____

AQUATIC HABITAT CARDS: D

You have saltwater and a big body of water. When the wind blows, waves roll over your surface. During storms the waves get huge. Things on you are far from land.

You are _____

Your rocky shore is covered with seaweeds that live attached to the rocks. When the salt water is at low tide, the sun, snow, or rain falls on your seaweeds and animals. Waves crash into you, so animals and plants have ways of clinging tightly to your rocks.

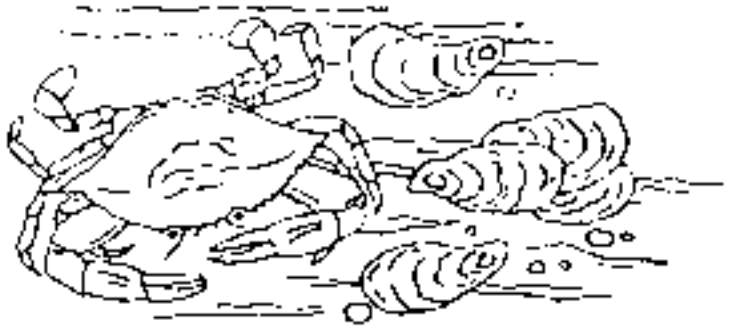
You are _____

You have cold, salt water. You are found near rocky shores. Your plants and animals are always covered by your cold water. You have forests of seaweeds called kelp which hide hundreds of kinds of animals.

You are _____

Salt water mixes with fresh water from a river in your wide shallow waters. You have lots of food for fish and crabs in your open waters above your muddy bottom. You are a nursery for many ocean animals.

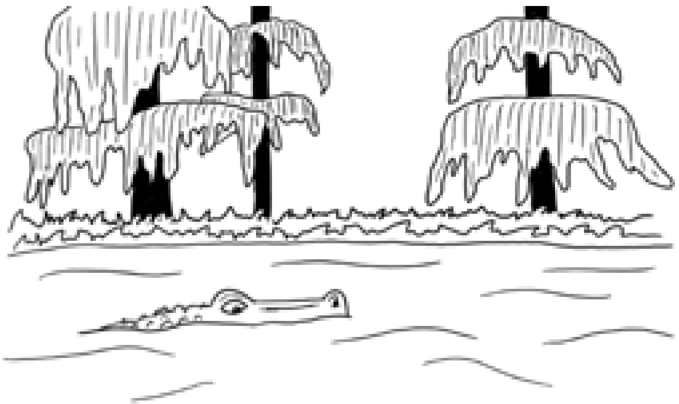
You are _____



AQUATIC HABITAT CARDS: E

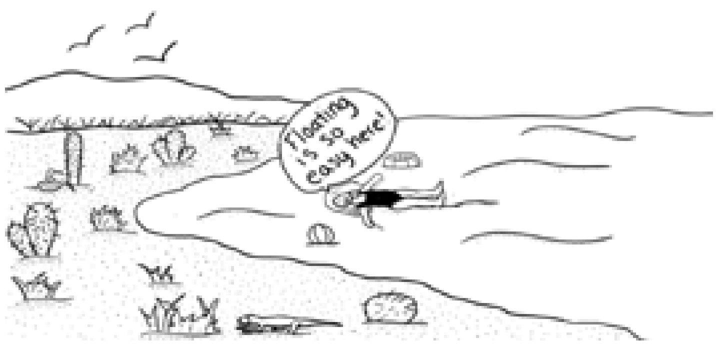
Tall trees stand in your quiet water. Freshwater turtles bask in a patch of sun while mosquitos buzz. It is very dark in the shade of the trees.

You are ______________________________



Your water is very salty, saltier than the sea. Water flows into you, but there is no way for it to leave except by evaporation in the hot sun. You form in low areas in deserts.

You are ______________________________



ACTIVITY #8: Sonar -- One Way Only

TIME: 45-60 Minutes

OBJECTIVE:

1. Students will demonstrate the knowledge of sonic depth sounding.
2. Students will be able to predict, compare, collect data, and draw conclusions from their investigations.
3. Students will graph data, using the method of averaging with decimals.

MATERIALS (per group):

Data Sheets (2 per student)
Thumbtack
1 gallon clear container
Plastic bag fastener
Penny
Paperclip
Rubber band
Stopwatch

TEACHER BACKGROUND INFORMATION: Sonic depth recorders are used for determining the profile of the ocean's floor. These sound waves are reflected back to the ship, to the ocean bottom, and back again to the ship. There they are picked up by a sonar receiver. Sound waves travel through saltwater at a rate of 1524 meters per second. Depth is then determined by using the formula D = 1/2 T (time) X V. The objects in this experiment only go down. Therefore, the time involved is one-half an echo-sounding.

PROCEDURE:

1. Practice dropping objects in the water before beginning the investigation.
2. Break the surface tension of the water before dropping the objects.
3. Distribute the materials to small groups of students.
4. Fill the container with water and drop each object five times into the water, timing, and recording each drop.
5. Average the data and group the results.

FORMATIVE EVALUATION:

1. Upon completion of this activity, students will understand sonic depth sounding.
2. Students will graph information by averaging the results of their timed drops.

LANGUAGE ARTS EXTENSION:

1. Pretend you are aboard an ocean vessel whose job it is to map unexplored oceans. Write a conversation between you and your captain about what you've discovered.
2. You are a salesman for Sonar - Where are you?, a sonar depth recording company. Create an advertisement for your most expensive model.

Water, Water, Here and There

Name _____

Mapping the Ocean Floor

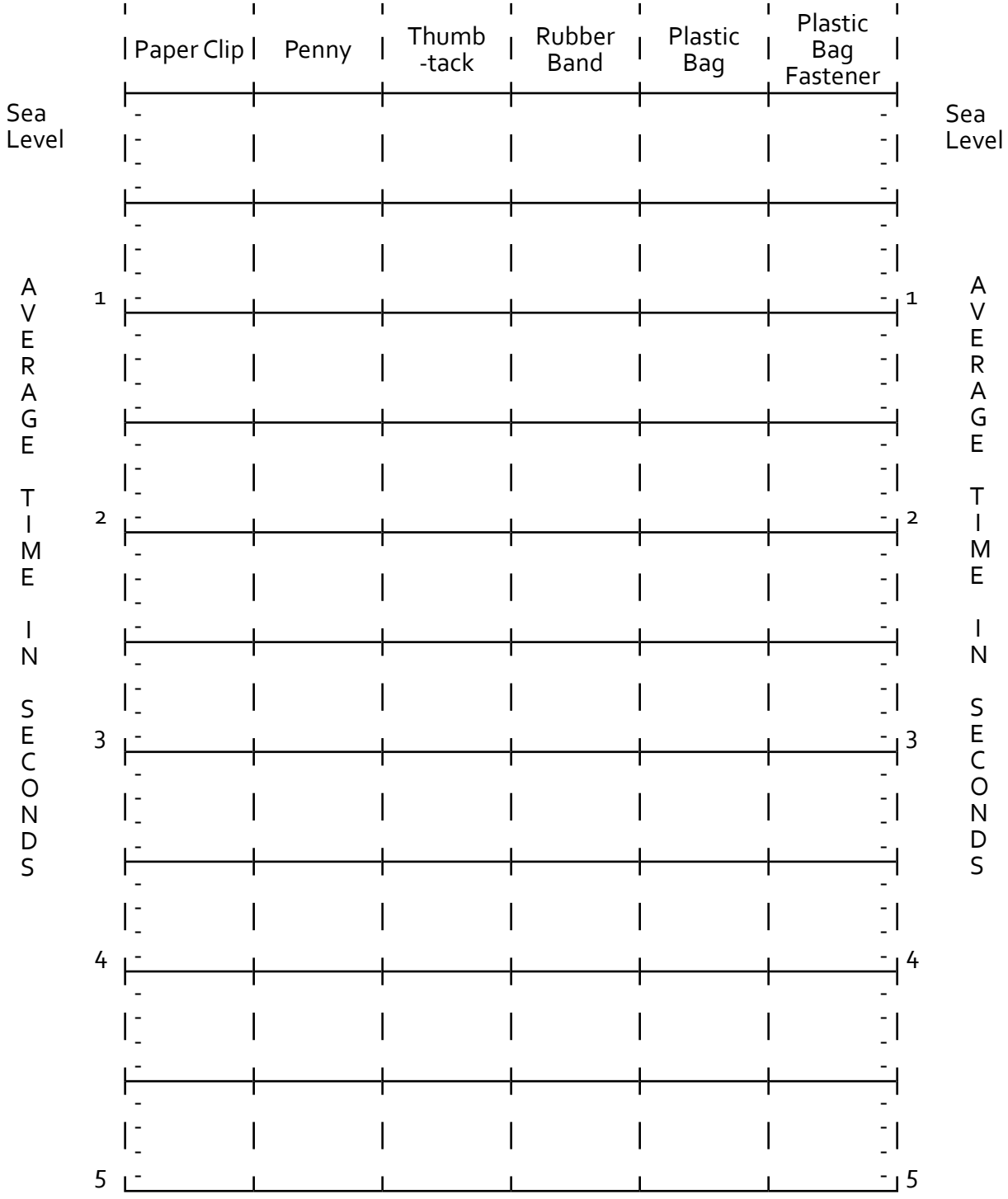
Drop each object 5 times. Record the time it takes to reach the bottom. Find the average.

	PAPERCLIP	PENNY	THUMB TACK	RUBBER BAND	PLASTIC BAG CONTAINER
DROP 1					
DROP 2					
DROP 3					
DROP 4					
DROP 5					
TOTAL					
AVERAGE					

Water, Water, Here and There

Mapping the Ocean Floor

Graph the average time in seconds for each item dropped. Color your graph to represent the ocean water and ocean floor.



ACTIVITY #9: Fishing for Survival

TIME: 30-45 Minutes

OBJECTIVE:

1. Students will be able to describe the evolution of fishing techniques from early to contemporary times.
2. Students will be able to demonstrate the effectiveness of some of the techniques by constructing and using models.
3. Students will construct a graph of the results of various fishing techniques.

MATERIALS (each group):

4 pieces of net of varying mesh sizes (1/8S, 1/4S, 1/2S, and 3/4S)
Variety of dried beans and grain (1 lb each: lima beans, black beans, pinto beans, lentils)
8 - 1 gallon aquariums
Student Activity Sheets

PROCEDURE:

1. Prepare the ocean by mixing all of the beans and grain together. Divide into 8 equal portions among the plastic containers. This will be the students fishing grounds.
2. Students will need to "name" their beans at this point. Names can be hypothetical or representative of fish native to your geographical area. Each bean should represent a fish species. Record this information on the chalkboard so that it is clearly visible to everyone in the room.
3. Divide the students into 8 groups and give each group their own fishing grounds. Teacher should lead a general discussion on fishing. Find out what students already know about fishing. Talk about the different techniques employed today as compared to ancient times.
4. Each group should receive one net of each size. Using the coarse netting first, stretch the net between the student's thumb and first finger; this expanse of net is the catching area. Ask each student to make one pass through the fishing grounds. Their catch should be emptied onto a plain piece of paper and then separated into like species and counted. This data should be entered on their activity sheet.
5. Next have students hold the net with two hands. Again, have them make one pass through the fishing grounds. Repeat the counting and recording procedures.
6. Discuss the findings. Which technique was more successful? How does this relate to the improvement in technology? Using both hands instead of one may represent the shift from hand-powered boats and cast nets to trawlers.
7. Instruct one student to then put 2-3 drops of yellow, red, and blue food coloring in each cup (one color per cup).
8. Repeat the above procedures for the other size nets. Record the results.
9. Have students construct a bar graph comparing the fishing results using different nets and different techniques.

Water, Water, Here and There

FORMATIVE EVALUATION:

1. Students will be evaluated on the completion of the student activity sheet.
2. Students will be evaluated on the completeness and accuracy of their graphs.

LANGUAGE ARTS EXTENSION: Have the students write an essay describing the conclusions they reached after participating in this activity. This could be included in their notebook or journal.

Water, Water, Here and There

Name _____

Fishing for Survival

Record your results on the charts below for each size of netting tested.

Net Size:

NAME	ONE-HAND GRAB	TWO-HAND GRAB

Net Size:

NAME	ONE-HAND GRAB	TWO-HAND GRAB

Net Size:

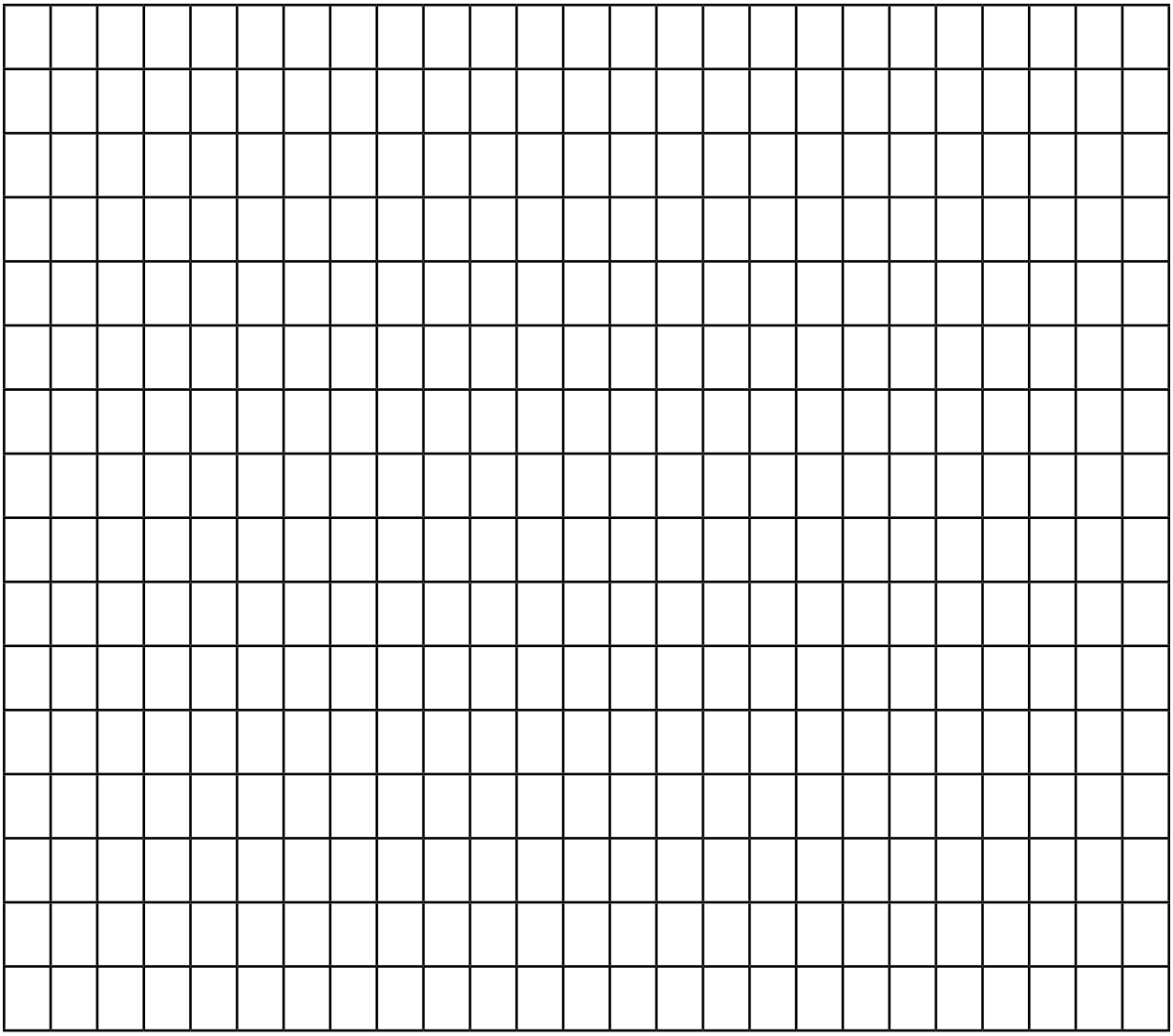
NAME	ONE-HAND GRAB	TWO-HAND GRAB

Water, Water, Here and There

Net Size:

NAME	ONE-HAND GRAB	TWO-HAND GRAB

Graph your results below:



ACTIVITY #10: How Big is a Whale?

OBJECTIVE:

1. Students will demonstrate the ability to draw an object to a given scale.
2. Students will demonstrate the ability to work in groups.
3. Students will list the characteristics of each species of whale.
4. Students will construct a drawing of a whale to scale.

MATERIALS:

Puzzle Pieces
Whale pdf (2)
1 cm grid paper
Sidewalk chalk
3 cm grid paper
18 cm paper squares
Projector

TEACHER/STUDENT PROVIDED MATERIALS:

Wire coat-hanger flags and string necessary for outlining a whale in grass

PROCEDURE:

NOTE: Provide the students with information so that they can do research and discover the difference between baleen and toothed whales. Discuss the differences and similarities.

1. Begin by having a 3 cm grip (approximately 15 cm across and 21 cm tall) drawn on the chalkboard. Next to this, draw a 6 cm grid (approximately 30 cm across and 42 cm tall).
2. Explain the concept of scale drawings using the chalkboard models. Trace your hand on the smaller grid. Number each of the squares that contain part of the hand, and then number the corresponding squares on the larger grid. Look at all squares that contain a part of the hand. Choose any of these squares as your starting point. Find the corresponding number on the larger grid and copy what you see in the small grid into the larger one. Repeat this process for each of the squares. When complete, the larger grid should have an enlarged duplicate of your hand.
3. Give each student a puzzle piece, 1 cm grid paper, and 3 cm grid paper. The students should practice scale drawing by transferring the shape of the puzzle piece from a 1 cm grid to a 3 cm grid.
4. Explain to the students that the same procedure will be used to draw a whale on the playground.
5. Display the whale pdf on the projector.
6. Divide the class into groups of 3-4. Assign each group two of the squares on the grid (if possible). They will transfer the drawings on their squares to the 18 cm squares. Upon completion of all the squares, lay them out on the floor to see if any adjustments are necessary. Make sure that the lines meet going from one square to the next.

7. The groups should assemble outside and assist the teacher in constructing a 3-meter grid on the playground/blacktop. Number each square to correspond with the squares on the pdf. The sidewalk chalk or wire coat-hanger flags can be used to mark the grid. NOTE: Measure one or two 3-meter squares and estimate the others by pacing and comparing. In the grass, it is necessary to place a flag at the corners of the 3-meter squares.
8. After the squares are numbered, the groups will proceed to reproduce the drawing on the blacktop. As the students are working, remind them to be aware of their neighbors' drawing. It is best to determine starting points on the grid before beginning. NOTE: In the grass, it will be necessary to mark with a flag, where the outline of the whale crosses each grid line. Using string or twine, you can outline the whale.

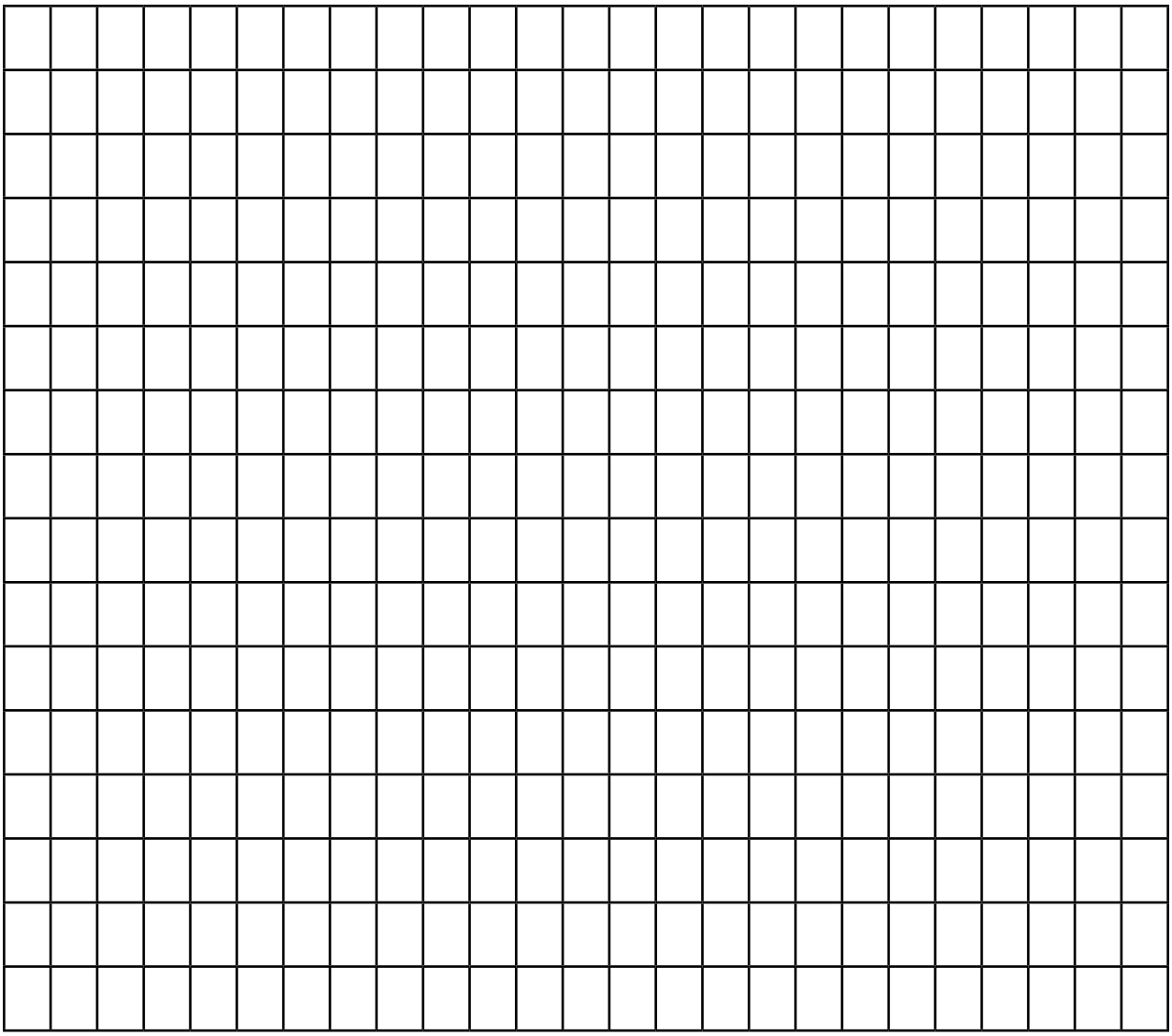
FORMATIVE EVALUATION:

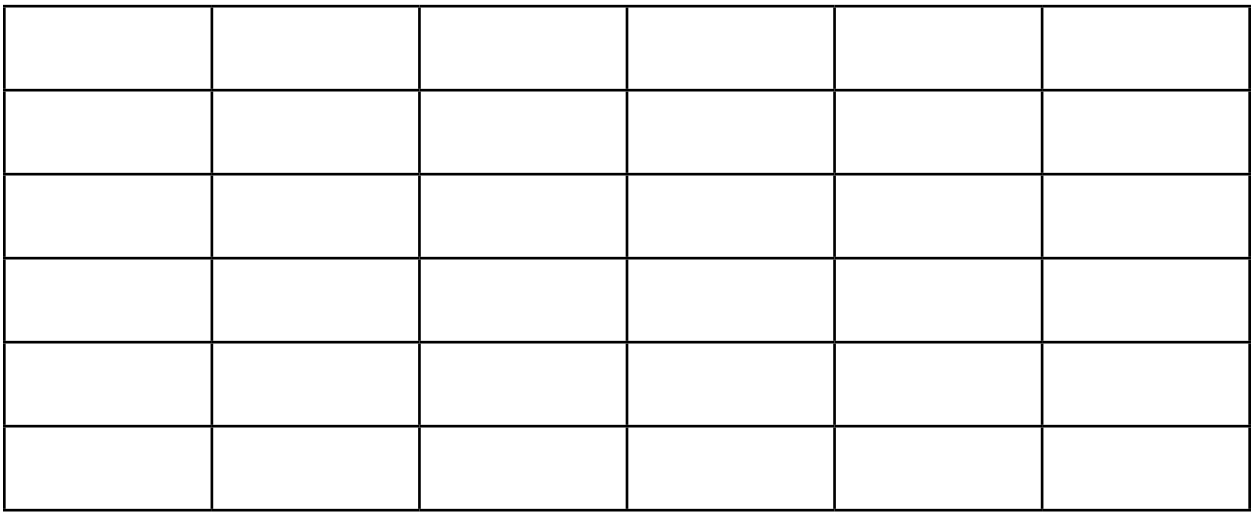
1. The students will be evaluated on the preliminary scale drawings and the finished whale drawing(s).
2. The students will be evaluated on their participation and their ability to work within their groups.

LANGUAGE ARTS EXTENSION:

1. Have the class imagine themselves to be scientists who can communicate with whales. Tell them to write stories telling what questions they would ask the whales. Perhaps they might predict how the whales would answer.
2. Have students write research reports on a specific type of whale giving information as to scientific name, family, size, habitat, characteristics, etc. Reports can be given orally before the rest of the class.

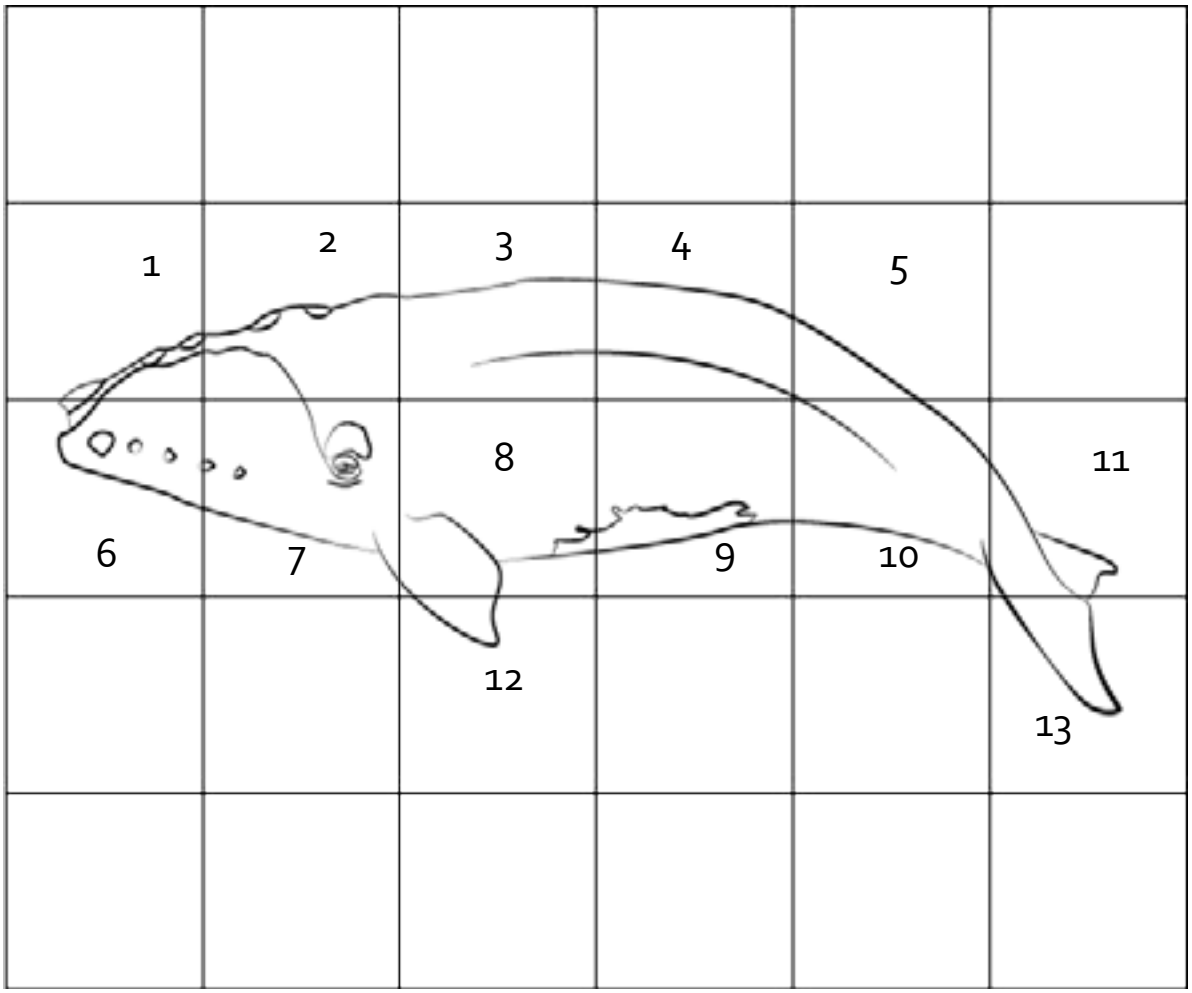
Water, Water, Here and There





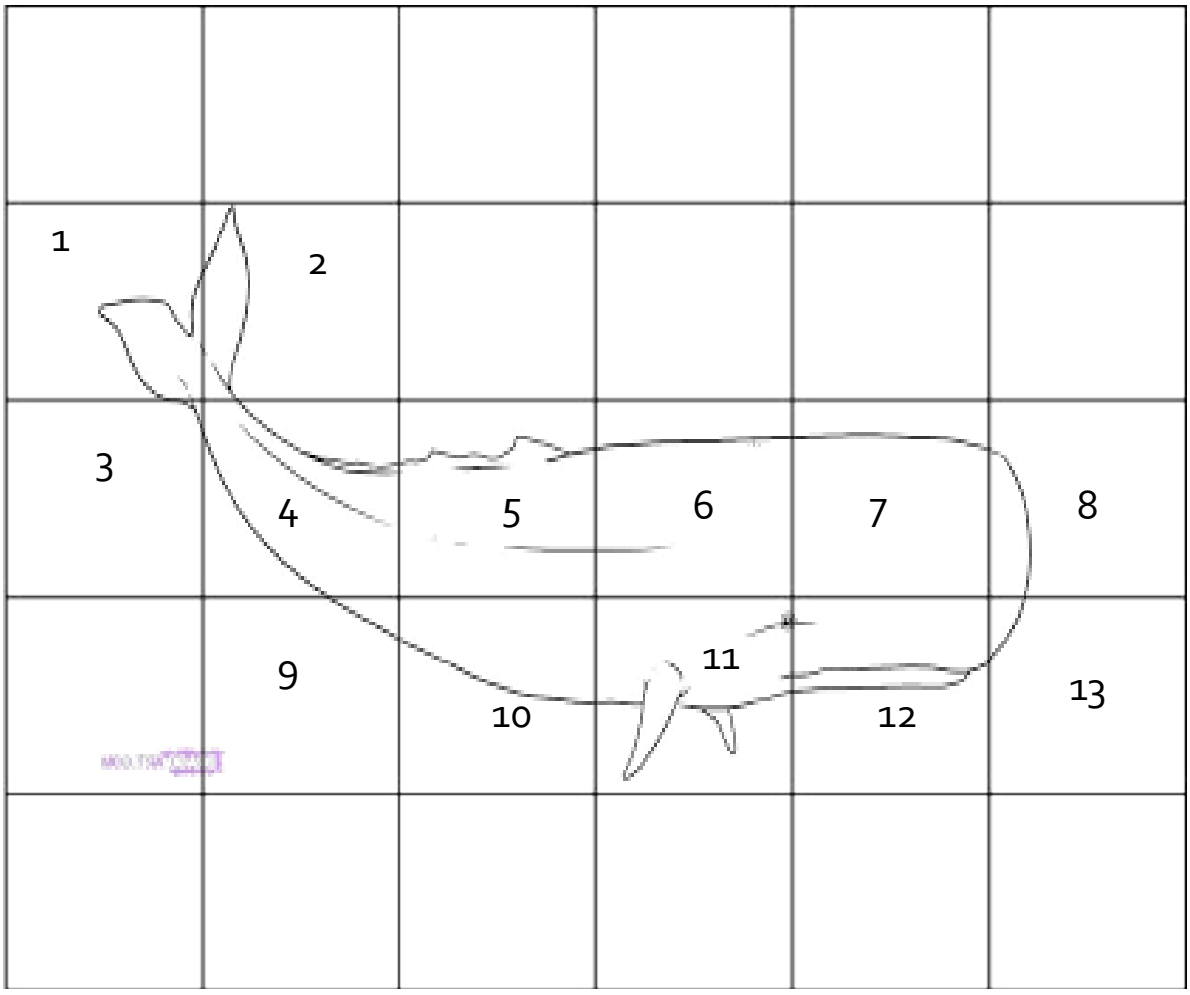
Water, Water, Here and There

Right Whale



Water, Water, Here and There

Sperm Whale



Glossary

BALEEN WHALES	Baleen whales have two nostrils, or blowholes, and moustache-like baleen plates in their mouths with which they strain food from the ocean floor. The Blue Whale and the Right Whale are examples of Baleen whales.
BRACKISH WATER	Brackish water is a mixture of freshwater and saltwater.
BUOYANCY	The tendency to remain afloat in water.
CHARACTERISTIC	A feature, trait, or property.
CLASSIFICATION	A systematic arrangement into groups or categories on the basis of characteristics shared in common.
DENSITY	The amount of matter (mass) of an object per unit of its volume.
DIFFUSE	Spread out or widely disperse.
DISSOLVE	The process in which molecules of one substance pull away from each other and attach to particles of another substance; to enter into a solution.
DRAWN TO SCALE	To draw in exact proportions to the size of an object.
ESTUARY	A semi-enclosed body of water where incoming seater is diluted with freshwater.
FRESHWATER	Water with a salinity of less than .5 parts per thousand; no salt taste.
HABITAT	A place normally occupied by a particular organism; kind of place such as a lake or stream.
MIXTURE	Does not combine chemically; can be separated without chemical change.
SALTWATER	Ocean or seawater; salinity of 35 parts per thousand.
SIPHON	A piece of tubing used to transfer a liquid from one container to another.
SOLUTION	Mixes evenly; is transparent; will not separate.
SURFACE TENSION	Condition at the surface of a fluid which acts as an elastic film due to the molecular forces within the fluid.
TOOTHED WHALES	Toothed whales have one nostril, or blowhole, and teeth. The Sperm whale, porpoises, and dolphins are examples of toothed whales.

Water, Water, Here and There

Name _____

Part A

1. According to scientists, the universal solvent is _____.
2. Objects sink or float depending on their _____.
3. The three characteristics of a solution are:
    1. _____
    2. _____
    3. _____
4. If an object's density is greater than water, the object will _____?
5. A _____ is a special kind of mixture.

Part B

Match the following:

1. _____ estuary
2. _____ siphon
3. _____ brackish water
4. _____ surface tension
5. _____ habitat
6. _____ characteristic
7. _____ saltwater
8. _____ draw to scale
9. _____ mixture
10. _____ solution

a. a feature, trait, or property

b. ocean or saltwater

c. a place normally occupied by a particular organism (plant, animal, etc.)

d. semi-encolsed body of water where incoming seawater is diluted with freshwater

e. condition at the surface of the water which acts as an elastic film

f. mixture of salt and freshwater

g. a piece of tubing used to transfer a liquid from one container to another.

h. drawn in exact proportion to size

i. does not combine chemically, can be separated without chemical change

j. mixes evenly, is transparent, will not separate when filtered

Water, Water, Here and There

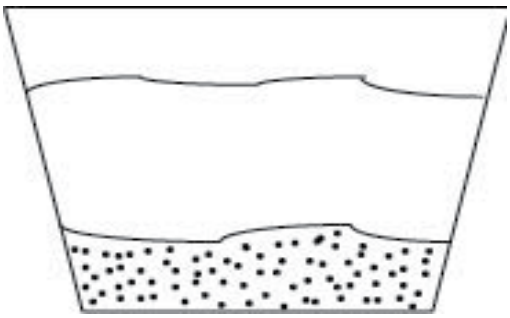
Name _____

Part C

1. Label freshwater and saltwater. Explain why this would happen.

   a. _____

   b. _____



2. Explain what would happen to an insect whose habitat was the surface of water if a camper dumped a pail of soapy water into the pond where the insect lived.

   _____

   _____

   _____

3. Why is it important to classify? Use the knowledge you gained from "Water, Water, Everywhere."

   _____

   _____

   _____

4. Plot the given soundings for a one way sonar graph.

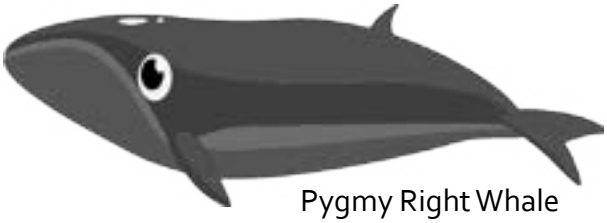
paper clip	5 seconds
thumb tack	2 seconds
rubber band	floated
marble	0.5 seconds

7				
6				
5				
4				
3				
2				
1				
	CLIP	TACK	BAND	MARBLE

Name _____

Student Activity Sheet No. 1 Baleen Whales

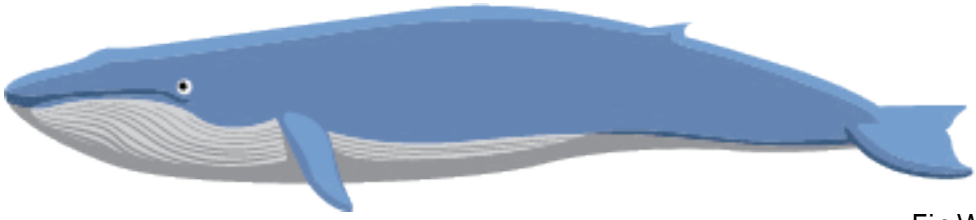
Mysticeti (from the Greek words Mystak meaning "moustache" and Ketos meaning "whale"). Baleen whales have two nostrils, or blowholes, and moustache-like baleen plates in their mouths with which they strain food from sea water. The Blue whale is the largest animal that has ever lived.



Pygmy Right Whale

Humpback Whale

Blue Whale

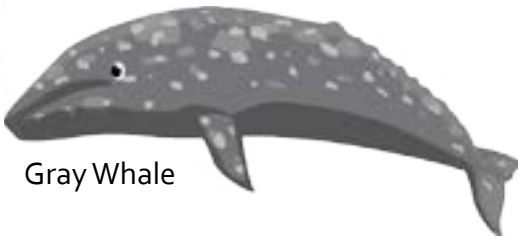


Fin Whale

Minke Whale

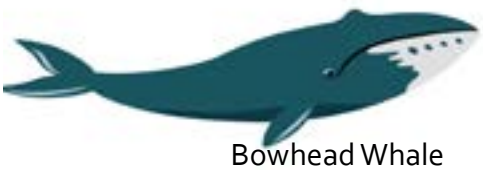
North Atlantic Right Whale

Sei Whale



Gray Whale

Bryde's Whale



Bowhead Whale

BALEEN WHALES

Biological Descriptions

Teacher's Note: Whale population figures and even the biological measurements of average length, weight, and life span are constantly being revised. Data provided below was provided by NOAA Fisheries. They should be viewed as our current best estimates.

Blue Whale (*Balaenoptera musculus*)

Length: up to 110 feet. Weight: 90-200 tons. Baleen: 270-395 black plates on each site, up to 3 feet long. Color: mottled bluish gray. Body: long, streamlined, small 12-inch dorsal fin set far back, long pointed flippers, broad straight-edged flukes, and two blowholes. Range and Habitat: world oceans, offshore and pelagic, migratory. Status: endangered. Calves: 23 feet, 5,500 pounds at birth.

Comments: largest animal ever to have lived; pouch or "cavum ventrale" may hold 1,000 tons of water and food, expands to six times in size when feeding.

Fin Whale (*Balaenoptera physalus*)

Length: 75-85 feet. Weight: 40-80 tons. Baleen: 260-480 per side, 2 feet long. Color: dark dorsal side, white ventral side, asymmetrical coloring - more white on right side around head. Body: slender, elongated dorsal fin 24 inches curved, head is narrow and V-shaped. Range and Habitat: world oceans, deep water. Status: endangered. Calves: 20-21 feet long, 2 tons.

Comments: very fast swimmer, travels in groups of 6-7; produces low frequency sounds at the lower limit of human hearing, individuals identified by chevron patterns.

Gray Whale (*Eschrichtius robustus*)

Length: 42-49 feet. Weight: male - 16 tons, female - 31-34 tons. Baleen: 130-180 yellowish plates on each side. Color: mottled gray, barnacles, yellow or orange patches from whale lice. Body: tubular, tapering at both sides, small flippers with pointed tips, wide flukes. Range and Habitat: Pacific coast of North America, near shore. Status: western North Pacific population is endangered, eastern North Pacific population is stable. Calves: 12-15 feet, 1-1 1/2 tons.

Comments: first whale of the modern "whale watchers," almost driven to extinction by whalers; strong bond between cows and calves; feeds by sucking up food near the bottom, leaving trails of mud.

Bryde's Whale (*Balaenoptera edeni*)

Length: 40-55 feet. Weight: 45 tons. Baleen: 300 per side, gray in color, 16 1/2 inches long. Color: light gray to black, lighter on ventral surface. Body: similar to sei whale, ghigh dorsal fin of 18 inches, 3 prominent head ridges. Range and Habitat: tropical Pacific, Atlantic, and Indian oceans. Status: Gulf of Mexico subspecies is endangered, stable in other ranges. Calves: 10-14 feet, 1-1 1/2 tons.

Comments: pronounced "Brew-dahs," only rorqual that does not migrate to polar regions in summer to feed and suckle young; commonly confused with Sei Whales.

Water, Water, Here and There

Bowhead Whale (*Balaena mysticetus*)

Length: up to 60 feet. Weight: up to 200 tons. Baleen: 230-360 plates each side, up to 14 feet long. Color: all black, spotted white chin patch. Body: thickset, huge head 1/3 of length, no dorsal fin, spatulate flippers, indent behind blowhole. Range and Habitat: Arctic pack ice around Alaska. Status: endangered. Calves: 13-15 feet.

Comments: longest baleen of all whales; travels alone or in small groups of 2 or 3; makes distinctive repetitive calls.

Humpback Whale (*Megaptera novaeangliae*)

Length: up to 60 feet. Weight: up to 40 tons. Baleen: 300-400 plates per side, 2 - 2 1/2 feet long. Color: black with variable white patches on flukes and ventral surface. Body: narrows quickly after dorsal hump, long wing-like flippers, slightly flattened head; tubercles, bumps or "stovebolts" are characteristic. Range and Habitat: worldwide. Status: endangered in Central America, western North Pacific, Arabian Sea, Cape Verde Islands; threatened in Mexico. Calves: 15 feet, 1 1/2 tons.

Comments: the "songs" of the Humpback whale are the longest and most melodious. Known for magnificent breaches; individuals are identified by fluke patterns. Often observed in large groups in their breeding and calving grounds.

North Atlantic Right Whale (*Eubalaena glacialis*)

Length: up to 52 feet. Weight: up to 70 tons. Baleen: 206-268 each side, up to 8 feet long. Color: black, occasionally mottled white patches on belly, callosities on head range from pink to white. Body: large and stocky, huge head, long and narrow upper jaw, jaws highly arched. Range and Habitat near and offshore cooler waters of Northern hemisphere. Status: endangered. Calves: 15-20 feet.

Comments: individuals can be recognized by individual markings or callosities; called Right whale because it was the "right" whale for whalers to kill - it is a very slow simmer and floats when killed.

Minke Whale (*Balaenoptera acutorostrata*)

Length: about 35 feet. Weight: up to 10 tons. Baleen: 230-360 yellowish plates, 8-21 inches long. Color: dorsal surface is gray to black, ventral surface white, white band on dorsal side of flippers. Body: streamlines, narrow, single head ridge, high dorsal fin. Range and Habitat: world oceans to ice edge, usually in cooler waters. Status: endangered. Calves: 8-9 feet.

Comments: pronounced "Mink-ee," individuals can be identified by scars and natural markings.

Sei Whale (*Balaenoptera borealis*)

Length: 40-60 feet. Weight: up to 50 tons. Baleen: 219-402 each side, up to 2 1/2 feet long, fine textured, white plates near front of mouth. Color: dorsal surface is dark gray to black with blue on sides, ventral surface is lighter, sometimes pinkish. Body: sleek, streamlined, 2-foot dorsal fin, flippers shorter than Fin or Blue whales. Range and Habitat: worldwide, temperature seas. Status: endangered. Calves: 15 feet.

Comments: pronounced 'Say," very fast swimmer, little is known about them.

Pygmy Right Whale (*Caperea marginata*)

Length: 15-21 feet. Weight: 3-3 1/2 tons. Baleen: 230 yellow plates up each side, up to 27 inches long. Color: dark gray or black dorsal surface, pale gray ventral surface, pale streaks on back. Body: slim, small dorsal fin, flippers rounded and narrow. Range and Habitat: cooler waters of the southern oceans. Status: data insufficient.

Comments: very little is known about this smallest of the baleen whales.

Name _____

Student Activity Sheet No. 2 Toothed Whales

Odontoceti (from the Greek words Odontos meaning "tooth" and Ketow meaning "whale". Toothed whales have one nostril, or blowhole, and teeth. These include all porpoises and dolphins. Their food is made up of fish, squid, and, in some cases, other marine animals.

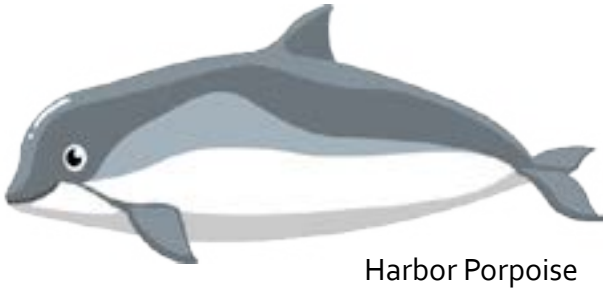
Baird's Beaked Whale

Orca

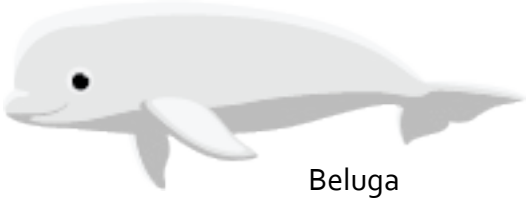
Amazon River Dolphin

Sperm Whale

Bottlenose Dolphin



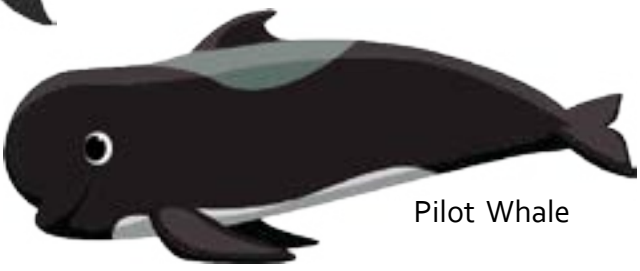
Harbor Porpoise



Beluga

Narwhal

False Killer Whale



Pilot Whale

TOOTHED WHALES

Biological Descriptions

Teacher's Note: Whale population figures and even the biological measurements of average length, weight, and life span are constantly being revised. Data provided below was provided by NOAA Fisheries. They should be viewed as our current best estimates.

Sperm Whale (*Physeter macrocephalus*)

Length: 40-52 feet, males are much larger than females. Weight: 15-45 tons. Teeth: 25 on each side of lower jaw. Color: dark brown to dark gray, belly area near mouth and head often light gray or white. Body: massive, large head comprises 1/4 to 1/3 of body length, short flippers, flukes like two jointed right-angled triangles. Range and Habitat: world oceans from equator to ice caps, pelagic. Status: endangered. Calves: 11 1/2 - 15 feet.

Comments: complex social structure, found in large groups; very deep diver staying underwater for up to two hours, deepest dive to 10,000 feet; head contains organ willed with a wax called spermaceti which is used for buoyancy control.

Narwhal (*Monodon monoceros*)

Length: 13-18 feet. Weight: 1,760-3,530 pounds. Teeth: none in the mouth, two imbedded in the upper jaw, in the male (rarely in the female) the left tooth grows to form a 5-10 foot tusk. Color: mottled gray-green, cream and black, whitening with age. Body: cylindrical, no dorsal fin, small up-curled flippers, flukes develop rounded trailing edge in older males, as a result flukes can appear to be attached backwards. Range and Habitat: high Arctic, deep water, amid pack ice. Status: nearly threatened. Calves: 5 feet.

Comments: usually travel in groups of 20 individuals or less, groups may be segregated by sex, tusk may be used for jousting similar to bighorn sheep but evidence is not clear, tusk is highly prized by hunters.

Baird's Beaked Whale (*Berardius bairdii*)

Length: 35-36 feet. Weight: over 13 tons. Teeth: 1-2 on each side at tip of lower jaw. Color: bluish, dark gray, often brown tinged, ventral side lighter with white blotches on throat. Body: bulbous forehead, long beach appears white tipped due to protruding teeth, long, round torso, small triangular dorsal fin set far back on body. Range and Habitat: North Pacific, temperate waters. Status: data insufficient. Calves: 15 feet.

Comments: travels in groups of up to 30 animals; dives for up to 45 minutes.

Beluga (*Delphinapterus leucas*)

Length: 10-16 feet. Weight: 1,100-3,300 pounds. Teeth: up to 11 conical teeth in each side of upper and lower jaw. Color: white. Body: chubby, clearly defined neck, no dorsal fin, flippers broad and short. Range and Habitat: Arctic, shallow waters, rivers estuaries small group in St. Lawrence River and North Pacific. Status: Cook Inlet population endangered; other populations stable. Calves: 5 feet, bluish gray.

Comments: travel in small groups, in summer form herds of hundreds or thousands, called "sea canaries" because of their vocalizing, unlike other whales can turn head sideways almost at right angles.

Orca (*Orcinus orca*)

Length: up to 32 feet. Weight: up to 11 tons. Teeth: 10-13 conical teeth on each side. Color: black on back and sides, white oval patch above and behind eye, white flank and belly, gray saddle behind dorsal fin. Body: stout, torpedo-shaped, rounded paddle-shaped flippers, very tall dorsal fin. Range and Habitat: world oceans, cooler inshore waters. Status: Southern Resident population endangered; other populations stable. Calves: 7 feet, 450 pounds.

Comments: a member of the dophin family, also called Killer Whale, travels in pods of 5-50, social structure is permanent close-knit "family"; top speed of almost 30 mph, eats other whales and seals as fish.

False Killer Whale (*Pseudora crassidens*)

Length: 16-20 feet. Weight: up to 3,000 pounds. Teeth: 8-11 large teeth on each side of both jaws. Color: black, anchor-shaped mark on chest. Body: long, slim, gently tapering head, 16-inch curved dorsal fin, flukes pointed at tips. Range and Habitat: world oceans, offshore, tropical. Status: endangered in the Main Hawaiian Islands Insular; other populations stable. Calves: 5-6 feet.

Comments: also called Pseudorca, found in groups of 2-50, groups of 200 or more have been sighted, swims 14-16 mph, like Orcas will feed on other whales.

Pilot Whale (*Globicephala malaena*)

Length: 16-20 feet. Weight: 1-3 tons. Teeth: 7-12 on each side of jaw. Color: black on back, anchor-shaped patch on belly and chin area. Body: bulbous head, dorsal fin low and thick, slightly protruding upper lip. Range and Habitat: world oceans, cool temperature waters. Status: stable. Calves: 5 1/2 feet.

Comments: found in pods of hundreds or even thousands of animals, the pods are controlled by one or more leaders or "pilots," still heavily whaled, also known as "potheads" or "blackfish."

Bottlenose Dolphin (*Tursiops truncatus*)

Length: 6-13 feet. Weight: 330-1,440 pounds. Teeth: 20-26 each side upper jaw, 18-24 each side lower jaw. Color: dark gray on dorsal surface, light gray on flanks becoming white or pink on ventral surface. Body: stout sleep body, sickle-shaped dorsal fin, robust head with distinct short beak. Range and Habitat: world oceans, temperate water, inshore and offshore population. Status: stable. Calves: 4 feet.

Comments: very gregarious, this is the species of dolphin often seen performing in zoos and aquariums.

Amazon River Dolphin (*Inia geoffrensis*)

Length: 8-10 feet. Weight: up to 450 pounds. Teeth: 25-35 each side, conical and thickened. Color: dark bluish gray above, pink on belly. Body: heavy-set, rounded forehead, large wide flukes and flippers, low dorsal ridge, no dorsal fin. Range and Habitat: Amazon and Orinoco river basins of South America. Status: stable.

Comments: almost blind, very sensitive echo-location, the most primitive of dolphins, solitary with little socialization.

Harbor Porpoise (*Phocoena phocoena*)

Length: 5-6 feet. Weight: 135-170 pounds. Teeth: 19-28 on each side of both jaws. Color: dark gray to black on dorsal surface, lighter below, dark gray line from mouth to base of flippers, triangular-shaped small dorsal fin. Range and Habitat: northern hemisphere, ice-free coastal waters. Status: data insufficient. Calves: 2 1/2-3 feet.

Comments: travels in groups of 10 animals or less, highly active.

LIVING IN WATER

an aquatic science curriculum
for supper elementary/middle school

Eight consulting teachers from Maryland, Pennsylvania, Virginia, Delaware, and the District of Columbia helped design Living in Water, a 315 page, 36 activity, classroom-based aquatic science curriculum which used hands-on science experiments and activities to teach children the physical and biological characters of marine and freshwater habitats. It was written and tested by Department of Education and Interpretation staff of the National Aquarium in Baltimore with funding from an NSF grant. The consulting teachers also tested it in their classrooms. The first edition was printed in June, 1987. Part or all of Living in Water has been adopted in upper elementary and middle schools nationwide. It is also used in programs and teacher training by aquariums, science centers, and university science educators. Living in Water won the 1988 Education Award from the American Association of Zoological Parks and Aquariums.

The second edition of Living in Water (produced in June, 1989, using teacher evaluations for revision) is sold at the cost of printing and mailing. It is printed on heavy white paper and is three-hold punched. All content and preparation information needed to teach Living in Water is included.

To order, send a check payable to the National Aquarium in Baltimore. We **cannot accept purchase orders for less than one full box.** Purchase orders for smaller amounts will be returned. Orders for boxes must include a street address to which UPS can deliver. Send $10 (to the US east of Rockies), $12 (to the US west of Rockies and Canada), or $150 per box (20 copies per box) sent UPS to the US or Canada to: Education Department, National Aquarium in Baltimore, Pier 3, 501 E. Pratt St., Baltimore, MD 21202-3194.

Water, Water, Here and There

Water, Water, Here and There Test
Answer Key

Part A

1. water
2. density
3. a) transparency
   b) mixes evenly
   c) will not separate when filtered
4. sink
5. solution

Part B

1. d
2. g
3. f
4. e
5. c
6. a
7. b
8. h
9. i
10. j

Part C

1. a) fresh water -> less dense; it floats
   b) salt water -> more dense; it sinks
2. The soal braks the surface tnesion of the water, making it difficult/impossible for the insect to remain on the surface
3. NOTE: There are several possible answers. By placing items in groups by characteristics (or classifying), you know something about any item that belongs to that group, even if you do not have previous knowledge of it.