EXPLORATIONS

Activity 3

How Salty Is It?

Concepts/Skills

- Multiplication
- Division
- Measurement
- Problem-solving skills

Materials

- TI–15 calculators
- Chart paper
- Marker
- Three 5-gallon aquariums
- Sea salt
- Warm water
- Various objects to float

Overview

Students will work in cooperative groups to solve a real-world problem involving salt water. Each group will determine the amount of sea salt needed to turn an aquarium into a simulated salt-water environment. An extension to the mathematics activity is to perform a "sink or float" experiment with the three examples of salt water.

Focus

Ask students to explain the term *salt water*. Have them discuss the possibility of different bodies of salt water having different amounts of salt in the water. Use a map to locate various salt water bodies including the oceans, Mono Lake, the Great Salt Lake, the Dead Sea, and so forth.

Presenting the Problem

1. Review the four steps of problem solving with the students:
   - understanding the problem
   - making a plan
   - carrying out the plan
   - evaluating the solution

   Have the students read *The Problem* page and paraphrase the problem. Make sure the students are clear on what the problem asks.

2. *The Problem* page gives the students the necessary information to solve the problem. Have the students make a plan and carry it out. Help them evaluate their solution before they begin making their chart to show their results.
3. If groups have difficulty with the problem, use the *Things to Consider* page. This page provides guiding questions to help the students complete the problem-solving steps.
4. Have the students post their charts showing the amount of salt required to make each kind of salt water.
5. As a class, compare the results of each group's calculations. Come to consensus about how the salt water should be created. Using the three aquariums, have students prepare the salt water. Once the salt water has been made, have the groups use the three aquariums to conduct a sink or float experiment.

Evaluating the Results

1. After the charts are posted and the experiment completed, have students examine the various solutions presented. Ask the students:
   - *How are the charts similar?*
   - *How are the charts different?*
2. Ask them to compare the numbers used.
   - *Did all groups use the same numbers?*
   - *Why do you think this is so?*
3. Ask them to determine the reasonableness of the results.
   - *Did each group answer the question?*
   - *Do the numbers used make sense?*
   - *Did all of the groups consider all of the variables?*
4. Ask them to determine how each group used the calculators.
   - *Did all of the groups use the calculators in the same way?*
5. Ask them to extend their thinking.
   - *What would happen if more salt were added to the Great Salt Lake aquarium?*
   - *What objects do you think would float?*
   - *How could you find out?*

Student Activity

Name _____

Date _____

Activity 3

How Salty Is It?

The Problem: How much sea salt will it take to create aquarium versions of an ocean, Mono Lake, and Great Salt Lake?

Your team has been asked to create three kinds of salt water: an ocean, Mono Lake, and Great Salt Lake. These three kinds of salt water will be used for a sink or float experiment.

The Facts

- About three-fourths of the world is covered with water. Some of the water is fresh water, but most of it is salt water.
- Not all salt water is the same. Some contains more dissolved chemicals than others.
- The dissolved chemicals are not exactly the same as table salt or sea salt (used in salt-water aquariums). For this experiment, you will use sea salt to simulate the level of dissolved chemicals.
- The ocean has about 24 grams of salt in each liter of water.
- Mono Lake in northern California has about 81 grams of salt in each liter of water.
- The Great Salt Lake's salt content changes. At its saltiest, the Great Salt Lake has about 120 grams of salt in each liter of water.
- Sea salt dissolves more easily in warm water.
- 1 liter = .26 gallons
- 1000 grams = 2.2 pounds

The Task

1. Your team will create a chart showing the following information:
   - The amount of salt it will take to make the water in a 5-gallon aquarium as salty as the ocean
   - The amount of salt it will take to make the water in a 5-gallon aquarium as salty as Mono Lake
   - The amount of salt it will take to make the water in a 5-gallon aquarium as salty as the Great Salt Lake

2. After the three aquariums have been set up by the class, you will try floating various objects in the three types of salt water. Add to your first chart the following information:
   - A list of items that sink in fresh water but float in ocean water
   - A list of items that sink in ocean water but float in Mono Lake water
   - A list of items that sink in Mono Lake water but float in Great Salt Lake water
   - Lists of items that stay suspended (neither float on the top or sink to the bottom) in each kind of water
3. Each person on the team will write an explanation of the team's solution. This explanation will answer these questions:
   - How did you calculate the amount of salt per kind of water? Do your calculations make sense? Did each kind of water use different amounts of salt?
   - Did you find items that sank in one kind of water and floated in another? Why do you suppose that happened?
   - If you wanted to make a 20-gallon aquarium as salty as ocean water, what would you do?

Things to Consider

Understanding the Problem

Read the *How Salty Is It? Problem Page,* and then answer these questions.

- How much salt does it take to make a liter of ocean water? A liter of Mono Lake water? A liter of Great Salt Lake water? How do you know?
- Is 1 liter more or less than 1 gallon? How do you know?

Making a Plan

Before you make your plan, answer these questions.

- How do you change from gallons to liters? Why do you need to do that for this problem?
- How do you know if an object sinks, floats, or is suspended in water?
- How do you make salt water?

Carrying Out the Plan

Before you begin your chart, answer these questions.

- What does your chart have to show? Do you have all of the necessary information? What other calculations do you need to make?
- How will you display your information on the chart? What additional information will you show on your chart? How many different objects did you use for the experiment? Did you find objects that would float, sink, or suspend in each kind of water? What other information do you know that might make your chart more informative?
- How can you make your chart clear and understandable to the class? Are the letters large enough? Are the colors dark? Is it easy to read?

Evaluating the Solution

- Did you answer the question? How do you know?
- Does your answer make sense? Did size make a difference in whether an object floated or sank? Why do you think that happened?
- Did everyone in the group write an explanation?

Using the Calculator

Name _____

Date _____

How Salty Is It?: Converting volumes

1. In health class, you learn that people should drink eight 8 oz. glasses of water a day. Your mother buys water in 1-liter bottles. You know that 1 liter = 33.8 ounces. How many 1-liter bottles do you need to drink to have your eight glasses?

Press:	The display shows:
8 × 8 Enter	

This gives you the number of ounces you need to drink each day.

Press:	The display shows:
64 ÷ 33.8 Enter	

This tells you how many 1-liter bottles you need to drink.

How many bottles would your mother need to buy so that you have enough water to drink?

2. You are making punch for a class party. The recipe calls for 1 gallon (128 ounces) of ginger ale. When you go to the store, you find that ginger ale comes in 2-liter bottles. How many 2-liter bottles do you need?

Press:	The display shows:
128 ÷ 33.8 Enter	

What is the answer? How many bottles do you need to buy? Remember, you calculated how many liters are in 1 gallon and the ginger ale comes in 2-liter bottles.

3. You are helping your dad paint the outside of your house. The paint sprayer holds one liter of paint. The paint comes in 5 gallon cans. How many times can you fill the sprayer from one can of paint?

Press:	The display shows:
5 × 128 Enter	

This gives you the number of ounces in 5 gallons.

Without clearing the calculator:

Press:	The display shows:
÷ 33.8 Enter	

What does this number tell you? How do you know?