Notes for Suitcase Oceanography Lesson 1: Why is the ocean salty?

Materials: Clear plastic tub
40 ping-pong balls
2 buckets, one labeled "inputs" and the other labeled "outputs"

Handouts: The Water Cycle
The Salt Cycle
Student worksheets
World map
Filipino Folk Tale

Vocabulary: mixture
solution
concentration
evaporation
precipitation
input
output

Activity:

Introduction:

1. Refer to world map. Ask students to estimate the ratio of ocean to land on the planet. Express that ratio as percentage, fraction, and decimal.
2. Note undersea mountain chains.

Discussion: The water cycle and the salt cycle

1. Refer to the drawing of the water cycle. Introduce vocabulary and explain the processes.
2. Refer to the drawing of the salt cycle. Define "input" and "output."
3. Ask: "What are some ways that salt might be put into the ocean?"
   "What are the ways that salt might be taken out of the ocean?"
4. Review/list salt inputs and outputs as they appear on the salt cycle drawing.

Experiment: Ping-pong Ball Ocean Chemistry

The amount and type of salt in the ocean has been the same for hundreds of millions of years. Why? This experiment will explore answers to that question.

Scientists use "models" to understand processes. The container is the ocean, and each ping-pong ball represents a given amount of salt. This is our "model ocean."

1. Review "input" and "output." Talk about rates, using the analogy of filling a bathtub with an open drain. If input rate = output rate, the system will not change.
2. Show how evaporation would leave behind salt as an evaporite by pulling some ping-pong balls out of the box and holding them along the edge.

3. Refer to worksheets:

Experiment 1: Every ten seconds, have a volunteer insert two ping-pong balls while another volunteer removes two ping-pong balls. Complete the data sheet with this input/output rate: 2 = 2. Ask students to graph the data. Then, ask: "What is the number of ping-pong balls in the container?" "What is the shape of the line on the graph?" "What would happen if we carried out this experiment for an hour?" "How many balls would be in the box?" "What prediction would you make if the experiment were carried out for 500 million years?"

Experiment 2: input = 2; output = 1.
Repeat the process of data collection and graphing as in Experiment 1. In addition, ask what this would mean for the salt in the system; bring up Great Salt Lake as an example. Make sure to discuss the concept of slope in the graph. As the line rises, the ocean is getting saltier.

Experiment 3: input = 2; output = 5.
Repeat the process of data collection and graphing as in Experiment 1. In addition, ask how long it would take for all the "salt" to be gone.

<u>Discussion:</u> the amount and type of salt has stayed constant in the world's oceans. Ask what that means about the input/output system. Which of the three experiments most accurately depicts this reality? Constancy is true for the system but isn't always the case from place to place. Demonstrate this by tipping the box of ping-pong balls toward one end. Show that the amount of balls stays constant, but the concentration is greater at one end of the box than at the other. Emphasize that this experiment has shown a "model" of the ocean. Scientists use models to understand processes.

<u>Assessment:</u> Refer students to the assessment sheet at the back of the experiment handout packet.

<u>Extension:</u> Ask students to contribute alternative versions of why the ocean is salty. Students may read the Filipino folk tale and compare it to other explanations. Students may write their own "folk tale" explanations.