

Mixtures and Solutions Lessons

These two lessons are part of the "Suitcase Lessons in Oceanography" for K-6 students developed by M. Torres and K. Falkner as part of a NSF GeoEducation grant. (GEO-0224566). Complete portable modules ("Suitcase Lessons") will allow any member of our faculty, and other institutes to introduce science concepts included in state and federal science standards, within the context of oceanographic science. The lessons are inquiry dominated, and are designed to complement the FOSS (Full Option Science System) science curriculum currently in use in the Linn-Benton-Lincoln Educational Service District. They are based on fundamental science principles, the process of scientific research and the excitement of discovery.

The lessons were generated with input from nine teachers from the school district, whose input was pivotal to the success of this effort. The teachers met several times with the scientist partners to brainstorm ideas for the lessons and to give feedback about possible lessons. They arranged for the scientist to teach the "suitcase" lesson to their class, and gave a pre- and post- knowledge assessment survey. After the lessons were presented, the teachers provided evaluations on the lessons' effectiveness and offered suggestions for improvement.

Each kit includes: Introductory materials that outline science concepts, detailed descriptions on how to use the materials, alignments to benchmarks, handouts and a complete set of materials needed to present the lesson to a class of ~30 students.

Evaluations include:

- Pre-class survey of the students' knowledge of a specific topic ("Why is the ocean salty?" and "Why is it important to know the salinity of seawater?")
- Assessment sheet to be completed by the students at the end of each lesson
- Evaluation sheet completed by the presenter based on students response, personal observations and any input from the teachers

The science concepts covered include:

- Review the concepts of solution and concentration, and introduce the concept of salinity.
- Review the water cycle and concepts of evaporation and precipitation.
- Discuss sources of salts to the ocean and ways salts are removed from the oceans, the salt cycle.
- Introduce the concept of mass conservation. In the ocean, input rate of salts equals output rate.
- Introduce the concept of density and the role of salinity in density.
- Discuss density and temperature currents, and the importance of understanding currents in the ocean.
- Discuss mechanisms that affect sea surface salinity: evaporation, precipitation and ice formation.
- Discuss techniques by which oceanographers can sample seawater to measure salinity.

Hands-on activities include:

- Observing and graphing changes in the inputs and output rates of "salts" in a "model" ocean using ping-pong balls in a transparent container.
- Observing behavior of substances with different densities.
- Determining whether an "unknown" vial filled with fluid is salt water or fresh water by observing whether it floats or sinks in fresh water.
- Predicting and observing the behavior of salty and fresh and warm and cold water using colored water in plastic bottles connected through a small orifice.