



Lesson Plan, Summer 2010

Brie Chaney-Ryan, BU RET 2010

Title
Salt water detectives
Primary Subject Area
General Chemistry
Grade Level
10 th grade, after a physics class
Overview
<p>The RET project that this is loosely based off of primarily dealt with optics and physics. However, a large component of the optimization of the project was knowing the physical properties of the materials we were using, and how they interacted with light and sound. These physical properties relate well to the first components of a chemistry curriculum, in which the students are beginning to think about matter in a different way, and notice it has certain properties that they can observe and later explain. This lesson serves as a review of some of the properties of matter, as well as some concepts inherent in solution chemistry. It also ties back into basic optics and the concepts of refractive indices from a previous general physics class. The lesson also serves as a safe and structured introduction for the students to lab procedure and etiquette/behavior, while using relatively harmless materials.</p>
Approximate Duration
One long/lab class period
MA Framework
<p>SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations.</p> <p>Chemistry:</p> <ol style="list-style-type: none">1.1 Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes.1.2 Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures. <p>Physics:</p> <ol style="list-style-type: none">4.4 Describe qualitatively the basic principles of reflection and refraction of waves.

Interdisciplinary Connections
Connections with physics and materials science
Lesson Objectives
<p>Students will follow directions to make specific solutions of known composition.</p> <p>Students will test the physical properties of solutions such as density and refractive index.</p> <p>Students will observe the differences between a solution/mixture and a pure substance.</p> <p>Students will establish an preliminary qualitative understanding of concentration.</p>
Lesson Materials and Resources
<p>Polytetrafluoroethane tubing (Tygon), refractometer, scale, weigh-boats, conductivity tester(can be made from X-mas lights and battery), deionized water, graduated cylinders and other standard glassware, 1mL metal cube</p>
Technology Tools and Materials
<p>Refractometer, scale</p>
Background Information
<p>This lesson assumes that the students understand the basic concepts of a physics class, particularly electromagnetism(how electricity flows) and waves.</p>
Lesson Procedures
<p>The lab period begins with the teacher quickly walking the students through basic lab safety, such as the use of safety equipment and goggles. The teacher also demonstrates weighing something using a scale and weigh-boats, and how to tare the scale.</p> <p>The students then make up four beakers of salt solutions, one with no salt, and others with 1, 10, and 25 grams of salt, all in 100mL of DI water. The students will then cycle through 4 stations with their lab packet, each testing some property of their solutions. The stations are:</p> <p>Density -the students weigh and measure the volume of their solutions and another object to calculate density</p> <p>Conductivity -the students test the conductivity of the different solutions, and should note that higher salt content improves flow</p> <p>Refractive index -the students see how refractive index can make objects harder or easier to see -they measure the refractive index of their solutions, and then match to PTFE to attempt a “disappearing act”</p> <p>Mixtures -the students boil away a portion of their solution and compare it to plain water</p> <p>At the end of the lab, the students and teacher come together to discuss their findings and compare notes to</p>

see if anyone found something anomalous or if there were any misconceptions. Later classes that relate to these topics should refer back to the students' experience in this lab, and the students should be reminded that they have seen things before in this exploration.

Assessment Procedures

The main assessments come from the exploration sheet. Less formal assessments include evaluating students' lab technique and behavior, and their ability to work as a group and delegate.

Accommodations/Modifications

As needed for the class. Many materials are presented in a written form, but also discussed orally, the class has several visual and tactile components.

Reproducible Materials

Lab exploration sheet

Explorations and Extensions

This lesson and the students' experiences should be referred to throughout the rest of the class when appropriate, to give them a firm basis for new concepts

Lesson Development Resources

Refractive index table:

http://www.topac.com/salinity_brix.html

Polymer refractive indices:

http://www.texloc.com/closet/cl_refractiveindex.html

Making a qualitative conductivity tester:

http://www.exo.net/~emuller/activities/chemistry_summer_2007/Conductivity%20tester.pdf

Reflections

Contact Information