Citric Acid Saturation

Mixtures and Solutions

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South Carolina State Standards

Process skills and inquiries are not an isolated unit of instruction and should be embedded throughout the content areas. Safety issues should be addressed as developmentally appropriate.

A. Process Skills

1. **Observe**
   a. Use the senses and simple tools to gather information about objects or events such as size, shape, color, texture, sound, position, and change (qualitative observations).
3. **Measure**
   a. Use standard (U.S. customary and metric) to estimate and measure mass, length, area, perimeter, volume, and temperature to the nearest whole unit (quantitative observations).

4. **Communicate**
   a. Use drawings, tables, graphs, written and oral language to describe objects and explain ideas and actions.

5. **Infer**
   a. Explain or interpret an observation based on data and prior knowledge.
   b. Discriminate between observations and inferences.

6. **Predict**
   a. Use prior knowledge and observations to identify and explain in advance what will happen.
   b. Discriminate between inferences and predictions.

7. **Hypothesize**
   a. Devise a statement of assumption, based on observations, experiences, and research, that can be supported or refuted through experimentation.

8. **Define variables**
   a. Identify independent (manipulated), dependent (responding), and controlled variables in an experiment.

B. Inquiry

1. **Plan and conduct a simple investigation.**
   a. Identify questions that can be answered through scientific investigations.
   b. Design and conduct a scientific investigation.
   c. Use appropriate tools and techniques to gather, analyze, and interpret data.
   d. Develop descriptions, explanations, predictions, and models using evidence.
   e. Use mathematical thinking in all aspects of scientific inquiry.
   f. Communicate outcomes and explanations.

IV. Physical Science

Units of Study: Mixtures and Solutions
Forces, Motion, and Design

A. Properties of Matter

2. **Solubility is one characteristic property of a substance.**
   a. Distinguish various solids (e.g., cornstarch, sugar, salt, baking powder, and flour) based on observed solubility in water.
   b. Distinguish between solvent and solute.
   c. Investigate the effect of stirring, shaking, and crushing on the rate of dissolving of solutes.

Background Knowledge:

Citric acid comes from organic sources such as fruits. It is a common food additive in products that benefit from a little tangy taste, such as soft drinks and candies. In its pure form citric acid is extremely sour, a characteristic shared by all acids. Citric acid is a white crystalline material that readily dissolves in water to form a clear, colorless solution. It can cause irritation if it gets in the eyes or nose. The citric acid used in this module is an inexpensive, food grade, granular, anhydrous citric acid. Purchase it from a chemical supply company. One 5ml spoon of the citric acid has a mass of about 4.5 grams. (STC Mixtures and Solutions Kit)

Solution- A type of mixture where one material dissolves into the other.

Solute- The solid part of a solution.

Solvent- The liquid part of a solution.

Saturated Solution- A solution in which the solid will no longer dissolve into the liquid.

Solubility- The property of a solid to be able to dissolve into a liquid.

Materials:(per group)

1 bottle, clear plastic, 120ml, with screw caps

3 plastic cups

1 FOSS funnel

1 Filter paper

1 Spoon 5 ml

1 sticky note

1 Container, ½ liter

1 Syringe

1 Balance

1 Mass set

Citric Acid

Engage:

Explain to the students that they are going to use what they know about saturation to investigate how much citric acid it takes to saturate 50 ml of water. Review what the students know about saturation. Introduce the students to citric acid. Ask the students if they can give any examples of foods that contain citric acid. Have the students make observations about citric acid and compare it to salt. Have the students make a prediction about whether it will take more or less citric acid than salt to saturate 50 ml of water.

Exploration:

Have the students work in groups of 3-4. Provide students with materials needed to saturate 50ml of water with citric acid. Have students discuss and record in their groups how to investigate how much citric acid is needed to saturate 50 ml of water. Discuss plan as a class and record steps in science notebook. Allow time for students to carry out investigation. Make sure that students are recording observations in science notebooks.

Explication:

Have students write a conclusion in their science notebooks about the results of their investigation. Discuss their results as a class.

- How many spoonfuls of citric acid did it take to saturated the 50ml of water?
- How do we know that the solution is saturated?
- What does it mean when a solution is saturated?
- What does it mean when a solid material dissolved into a liquid material?
- Did it take more or less citric acid that salt to saturate 50ml of water?

Introduce the term solubility with students. Solubility is the property of a solid to dissolve into a liquid.

Elaboration:

Ask the students how can we find out how many grams of citric acid it took to saturate 50ml of water. Review and discuss the steps groups should take to carry out this investigation. (The steps that should be taken in this experiment are the same steps we took to carry out the experiment with salt saturation).

- What is the only way to separate solid material that did not dissolve into the solution? (filter)
- What is the only way to separate the solid material that did dissolve into the solution? (evaporation)

Have students get filters, funnel, balance and gram pieces in order to carry out investigation. Have students write conclusion and discuss their results.

Evaluation:

Students will be given the following journal question provided by the Mixtures and Solutions Foss Kit to answer as a type of assessment.

Jasmine and Mack were making instant iced tea. In the ½ liter glasses, Mack put two spoonfuls of iced-tea powder and Jasmine put four spoonfuls. Both filled their glasses half full with water from the tap. Mack stirred his mixture and it all dissolved. Jasmine stirred hers, and it didn't all dissolve.

"I think you have a saturated solution," said Mack. "Why don't you add more water?"

“I know another way to make it dissolve,” said Jasmine.

Would Mack’s suggestion to add more water work? Explain your answer.
What could Jasmine do to make the powder dissolve?

Students will also be assessed through the means of a quiz.