

**Orange Juice to Strawberry Float**

**A Foamy Acid-Base Demonstration**



**Introduction**

It’s big, it’s colorful, it’s messy, and it’s chemistry! Watch as the “orange juice” in a beaker changes into a foamy “strawberry float.” What a great way to introduce acids and bases to your students!

**Chemical Concepts**

* Acids and Bases
* Acid-base indicators

**Materials (for each Demonstration)**

Sodium bicarbonate, NaHCO3, 50 g Tap water, approximately 300 mL

Alconox@ soap, 50 g Large tray or aquarium

Methyl orange, 0.5% solution, 100 mL Stirring rod, long

Hydrochloric acid, 3 M, HCl, 270-280 mL Beakers 2-L and 600 mL

***Safety Precautions***

*Hydrochloric acid (3 M) is moderately toxic by ingestion and inhalation; it is corrosive to body tissues, especially to the eyes. Methyl orange solution (0.5%) is slightly toxic by ingestion. Alconox@ and sodium bicarbonate are irritants, especially to the eyes. This demonstration rapidly generates a foamy mixture which may spray in all directions. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron.*

**Procedure**

1. Place a very large tray on the demonstration table.
2. Add approximately 300 mL of tap water to a 2-L beaker.
3. Add 50 g sodium bicarbonate and 50 g Alconox@ to the 2-L beaker. Stir the solution with the long stirring rod. All of the solid may not dissolve.
4. Add 100 mL of 0.5% solution methyl orange indicator to the beaker containing the sodium bicarbonate and Alconox@. Stir. The resulting solution should look somewhat like orange juice; however, the orange solution is thicker and darker in color than actual orange juice.
5. Add approximately 270-280 mL of 3 M hydrochloric acid to a 600-mL beaker.
6. Place the beaker containing the sodium bicarbonate mixture in the center of a very large tray or in the sink or in an aquarium.
7. Wearing chemical splash goggles, quickly but carefully, add the 270-280 mL of HCl all in one pour to the beaker containing the orange sodium bicarbonate mixture. Stand back, as the mixture will immediately erupt out of the beaker.
8. Note the color change of the mixture. The solution will look like a strawberry float, but after some time, parts of the solution will turn yellow.

**Disposal**

The resulting mixture should be diluted with water, neutralized, and flushed down the drain with plenty of water according to Flinn suggested Disposal Method #24b. Please consult your current *Flinn Scientific Catalog/Reference Manual*.

**Tips**

* This demonstration is very messy and may produce over 10 liters of soap bubbles that may still contain small amounts of hydrochloric acid. Please practice this demonstration before performing it in front of your students. All persons watching the demonstration should be wearing chemical splash goggles. All amounts can be cut in half for a safer and less messy (yet less dramatic) alternative.
* This demonstration can also be performed in 1-L or 3-L beaker. It is advised not to use an Erlenmeyer flask or a graduated cylinder as excessive splattering will erupt out of the narrow mouth.
* It is possible to substitute 75 g or 25 g of Alconox (rather than 50 g) for more or less foam, respectively. Liquid dish detergent also works (about three healthy squirts) but gives a lower quality foam. A less foamy reaction will occur using 25 g of sodium bicarbonate (rather than 50 g) and 1 M hydrochloric acid (rather than 3 M) with the same amount of soap (50 g).

**Discussion**

The sodium bicarbonate reacts with the hydrochloric acid in a neutralization reaction to produce sodium chloride, water and carbon dioxide gas according to the following equation:

NaHCO3(aq) + HCl(aq) →→ NaCl(aq) + H2O(1) + CO2(g)

Methyl orange is an acid-base indicator that turns from a yellow-orange color at pH 4.4 to a red color at pH 3.0. The initial basic solution has a deep orange color. The intensity of the yellow-orange solution is due to the high indicator concentration. Upon adding the acid, the pH drops and a strawberry red color forms. One of the products of this neutralization reaction is carbon dioxide gas, which is rapidly produced and becomes trapped in the soap bubbles. Over 13 liters of CO2 gas are produced in this reaction, resulting in an abundance of soap bubbles.

**Acknowledgments**

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