Ammonia Fountain with Bromthymol Blue

Weak Acids and Bases

Introduction

As ammonia gas dissolves in water, the pressure inside the inverted flask is lowered. This decrease in pressure draws the light yellow solution into the flask, which reacts to form a cascading blue fountain.

Concepts

- Weak base
- Solubility of gases

Materials

Ammonium hydroxide, NH_4OH, conc., 2–3 mL
Bromthymol blue indicator solution, 0.04%, 3 mL
Water, distilled or deionized, 1000 mL
Beaker, 1-L
Flask, round-bottom, 1-L
Glass tubing, 15–20 cm, 2 pieces
Medicine dropper
Rubber stopper, 2-hole
Stirring rod

Safety Precautions

Ammonia vapor is severely toxic and irritating by inhalation and may be fatal. Use only under a fume hood. Ammonia is also a moderate fire risk. Avoid contact of all chemicals with eyes, skin, and clothing. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please consult current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

1. Prepare the two-hole rubber stopper with water in the medicine dropper as shown in the diagram. Use rubber tubing to connect the glass tubing pieces.
2. Under an operating fume hood, add a few milliliters of concentrated ammonium hydroxide to the round-bottom flask and place it on a warm hot plate until the liquid evaporates.
3. Stopper and invert the flask. Clamp it to the ring stand as shown in Figure 1.

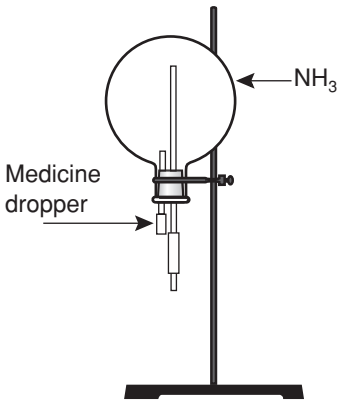

Figure 1.

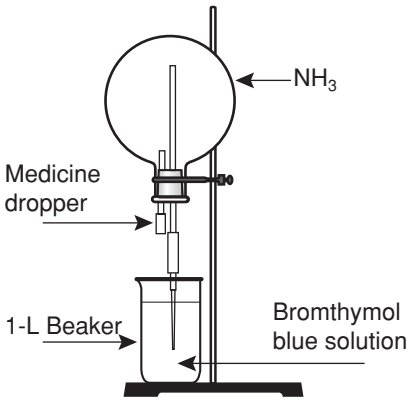

Figure 2.

Procedure

1. Fill the 1-L beaker with 1000 mL of distilled or deionized water. Add 2 to 3 mL of the bromthymol blue indicator solution. Stir to mix.
2. Place the beaker under the flask, with the glass tubing in the solution (see Figure 2).
3. Initiate the reaction by squeezing the medicine dropper and allowing a few drops of water to enter the flask.
4. The partial vacuum produced by the ammonia gas dissolving in the water will draw the solution up into the round bottom flask. As the solution enters the flask, the soluble ammonia changes the solution color to the basic blue of the bromthymol blue indicator.

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Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. The final solution may be rinsed down the drain with excess water according to Flinn Suggested Disposal Method #26b.

Discussion

Ammonia fountains dramatically show the solubility of ammonia gas in water. Initially, the flask is full of ammonia gas. When a few drops of water are injected into the system, some of the ammonia dissolves in the water. This lowers the pressure inside the flask, drawing up the two solutions. When the solutions enter the flask, more ammonia gas will dissolve, increasing the pressure difference to such a degree that a fountain effect is created.

$$NH_3(aq) + H_2O(1) \rightarrow NH_4^+(aq) + OH^-(aq) \qquad \textit{Equation 1}$$

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Systems, order, and organization
Evidence, models, and explanation
Content Standards: Grades 5–8
Content Standard B: Physical Science, properties and changes of properties in matter
Content Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Ammonia Fountain with Bromthymol Blue* activity, presented by Lee Marek, is available in *Weak Acids and Bases* and in *Properties of Ammonia*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Ammonia Fountain with Bromthymol Blue* are available from Flinn Scientific, Inc.

Catalog No.	Description
A0174	Ammonium Hydroxide, 100 mL
B0173	Bromthymol Blue Indicator Solution, 100 mL
GP4077	Boiling Flash, Round-Bottom

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.