

A New Approach for the Balloon in the Flask

What is Pressure?

Introduction

A balloon is forced into a flask using the high solubility of ammonia in water.

Concepts

- Solubility
- Gas laws
- Pressure

Materials

Ammonia source

Balloon, large and heavyweight

Option #1

Ammonium hydroxide, concentrated, NH_4OH , 20 mL Hot plate

Beaker, 100-mL

Option #2

Ammonia gas cylinder

Glass delivery tube, to fit stopper

Florence flask, 250-mL

One-hole stopper, to fit flask

Rubber tubing, to fit gas delivery tube and gas cylinder

Water, 5–10 mL

Safety Precautions

Ammonia is toxic and irritating by inhalation. Inhalation may be fatal. Use ammonia gas only under an operating fume hood.

Ammonia is a moderate fire risk. Wear chemical splash goggles, a chemical-resistant apron, and chemical-resistant gloves. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

For ammonia option #1:

1. In an operating fume hood, pour about 20 mL of the concentrated ammonium hydroxide into the flask.
2. Warm it gently on a hot plate until the gas is seen bubbling freely from the liquid. Heat until enough gas has been generated to completely fill the flask.
3. Pour the excess solution into a beaker for proper disposal later.
4. The one-hole stopper should be loosely in place on top of the flask while heating and after emptying.

For ammonia option #2:

1. Place the glass delivery tube in the flask and loosely insert the stopper beside the delivery tube (see Figure 1).
2. Attach one end of the rubber tubing to the glass delivery tube. Attach the other end to the gas cylinder.
3. Fill the flask with ammonia from the cylinder of gas.
4. When filled, remove the glass delivery tube, but continue to cover the mouth of the flask loosely with the stopper.

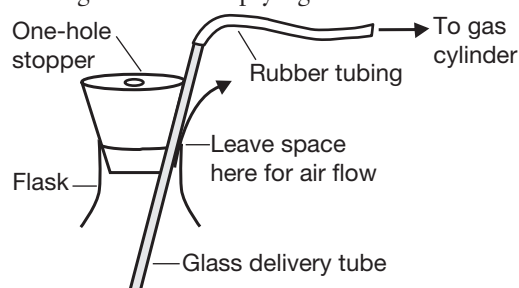


Figure 1.

Procedure

1. Put 5–10 mL of water into the balloon and pinch the balloon firmly.
2. Remove the stopper from the flask and quickly stretch the mouth of the balloon over the mouth of the flask.
3. Hold the balloon upright and allow the water to fall into the flask. Watch as the balloon is rapidly pushed into the flask. If the balloon does not fill the flask, there is probably air mixed with the ammonia.

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. Place all pieces of equipment in an operating fume hood overnight to remove all traces of the ammonia gas. After degassing, rinse all items, and flush the water down the drain. The balloon may be placed in the trash according to Flinn Suggested Disposal Method #26a. If using ammonia option #1, the excess ammonium hydroxide solution may be neutralized according to Flinn Suggested Disposal Method #10.

Discussion

A frequent challenge to students is to put a balloon into a flask or bottle. The usual way is to boil a small amount of water to fill the flask with steam, cap the hot flask with a balloon, and permit air pressure to take over. The filled balloon replaces the steam as it condenses causing the container to become the color of the balloon. Now a new method may be used.

The solubility of ammonia is so great in water that atmospheric pressure is able to nearly fill a flask that has been filled with ammonia gas in the usual ammonia fountain (*A Demo a Day*[™]—*A Year of Chemical Demonstrations*, Flinn Catalog No. AP8852, page 148–149).

This demonstration couples these two concepts. A flask is filled with ammonia gas and covered with a balloon that contains a small amount of water. The water is then mixed with the ammonia gas and the gas dissolves in the water. A decrease in pressure inside the balloon/flask system allows atmospheric pressure to push the balloon into the flask. The flask again takes on the color of the balloon.

Connecting to the National Standards

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

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation
Constancy, change, and measurement

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter, motions and forces

Flinn Scientific—Teaching Chemistry[™] eLearning Video Series

A video of the *A New Approach for the Balloon in the Flask* activity, presented by George Gross, is available in *What is Pressure?*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *A New Approach for the Balloon in the Flask* are available from Flinn Scientific, Inc.

Catalog No.	Description
A0174	Ammonium Hydroxide, Concentrated NH ₄ OH, 100 mL
AP1900	Balloons
GP3085	Florence Flask, 250 mL

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