

The Egg In and Out

What Is Pressure?



Introduction

Rediscover Amontons's law by using pressure to force an egg into an Erlenmeyer flask.

Concepts

- Pressure
- Amontons's law

Materials

Egg, hard-boiled

Erlenmeyer flask, borosilicate glass, to fit egg

Lighter or matches

Paper towel

Tongs

Wire formed into a hook

Safety Precautions

The Erlenmeyer flask will develop a slight vacuum as the hot air inside the flask cools. Use only borosilicate flasks with heavy-duty rims and carefully check the flask before use for chips or cracks. Have a source of water nearby to douse the flame if necessary. Wear chemical splash goggles. Wash hands thoroughly with soap and water before leaving the laboratory. Follow all laboratory safety guidelines.

Preparation

1. Hard boil and peel the egg.
2. Roll the paper towel into a tube shape.

Procedure

1. Grasp the paper towel with the tongs and light the paper towel.
2. Place the lit paper towel into the Erlenmeyer flask.
3. Place the egg pointed side down onto the lip of the Erlenmeyer flask.
4. After the egg has entered the flask, use a wire hook to remove the burned remains of the paper towel.
5. Lift the flask to your lips and press lips tightly and blow hard.
6. Release and catch the egg as it emerges from the bottle.

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 egg remains may be placed in the trash according to Flinn Suggested Disposal Method #26a.

Tip

- Use only borosilicate flasks. Do not use economy-choice flasks. Check the flask for chips or cracks before and after each use.

Discussion

Burning the paper heats the air inside the open bottle and causes the gas to expand and some of it to escape from the bottle. When the fire burns out, the remaining air is trapped in the bottle by the egg and subsequently cools down. As the temperature of the air in the bottle decreases, so does the gas pressure inside the bottle relative to that of the surrounding air outside the bottle. The greater pressure (force) of the outside air forces the egg into the flask. It is both the lower temperature and the fewer number of moles of air that cause the egg to be pushed into the bottle. This may be explained using Amontons's law.

In 1702, the French physicist Guillaume Amontons invented the air thermometer to measure temperature changes based on an increase in the volume of a gas as it was heated. Amontons also measured the pressure of a fixed volume of air as it was heated from room temperature to the temperature of boiling water. The relationship between the temperature and pressure of a gas is known as Amontons's law—the pressure of a gas is proportional to its temperature if the volume and the amount of the gas are held constant.

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

Evolution and equilibrium

Content Standards: Grades 5–8

Content Standard B: Physical Science, motions and forces

Content Standards: Grades 9–12

Content Standard B: Physical Science, motions and forces

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of *The Egg In and Out* activity, presented by DeWayne Leineman is available in *What Is Pressure?*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *The Egg In and Out* are available from Flinn Scientific, Inc.

Catalog No.	Description
GP3050	Erlenmeyer Flask, Borosilicate Glass, 500-mL
AP8960	Lighter, Butane, Safety, Single

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