# Boiling in a Balloon

Conservation of Energy

## Introduction

A perfect demonstration that dramatically shows the tremendous heat capacity of plain, ordinary water.

#### Concepts

• Heat transfer

• Specific heat

#### Materials

Water, 20 mL Balloons, 12" round, 3, 1 opaque Candles,  $5'' \times 1\frac{1}{4}''$ , 2 Lighter or matches

## Safety Precautions

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.

#### Procedure

- 1. Prepare three balloons for the demonstration. Add 20 mL of water to an opaque balloon and another 20 mL to a semi-transparent balloon. Blow up these balloons to a diameter of about 5 inches and tie them off. Take a third balloon and inflate it to the same size and tie it off.
- 2. Place the two candles on the bench top. Put the semi-transparent balloon with the water inside under the desk and place the other two balloons next to the candles.
- 3. Light the candles. Tell your students to predict how long these two balloons can remain inflated when placed in the flame.
- 4. Holding each balloon by the tied end, gently place each balloon just above the yellow flame of the candle. (Try not to flinch when the one balloon pops.)
- 5. After 5 to 10 seconds, take the opaque balloon out of the flame. Ask the students to hypothesize the reason behind this discrepant event.
- 6. After a bit of class discussion, show the students the semi-transparent balloon and the water it contains.

## Discussion

The heat capacity of water is the amount of heat energy that must be transferred to raise the temperature of one gram of water one degree. This value is 4.18 J/g. For the 20 mL of water in the balloon, this means that the water absorbs 83.6 J of heat energy for every degree of increased temperature. If the temperature is raised 40°C, this translates to 3344 J or 3.344 kJ of absorbed heat energy. This heat transfer prevents the balloon from bursting in the low heat flame of the candle.

© 2016 Flinn Scientific, Inc. All Rights Reserved.



# 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
Content Standards: Grades 5-8
 Content Standard B: Physical Science, properties and changes of properties in matter, motions and forces, transfer of
 energy
Content Standards: Grades 9-12
 Content Standard B: Physical Science, conservation of energy and increase in disorder, interactions of energy and
 matter

# Flinn Scientific—Teaching Chemistry<sup>TM</sup> eLearning Video Series

A video of the *Boiling in a Balloon* activity, presented by Lee Marek is available in *Conservation of Energy*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

#### The Boiling in a Balloon is available from Flinn Scientific, Inc.

Catalog No.	Description
AP1900	Balloons, Latex, 129 Round, 20/Pkg.
C0192	Candles, White, 59 5 1 <sup>1</sup> / <sub>4</sub> 9, 4/Pkg.

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