

# ARISE Curriculum Guide

## Chemistry: Topic 3—Problem Solving

### ChemMatters

[Order a CD with 25 years of ChemMatters](#), \$30

#### Articles for Student Use

Archimedes: Oct. 1987, p. 17.

The Crash of Flight 143: Oct. 1996, pp. 12-15.

Global Warming: Hot Topic Getting Hotter: Sep. 2001, pp. 14-15.

Homeopathy: Dec. 1991, pp. 8-11.

Murder She Floats: Dec. 2002, pp. 17-19.

Swimming Pools: April 1994, pp. 10-12.

#### Articles for Teacher Use

**Number and Topic:** 3. Problem Solving

**Source:** *ChemMatters*, April 2003, pp. 8-9, Student activity relating to the rate of energy release by a Bunsen burner, an electric hotplate and a microwave oven

**Type of Material:** Activity

**Building on:** Basic ability to do energy calculations

**Leading to:** Measuring and comparing the rate at which water can be heated by a Bunsen burner, and electric hotplate, and a microwave oven.

**Links to Physics:** Energy

**Links to Biology:**

**Good Stories:** None

**Activity Description:** This is a student activity measuring and comparing the rate at which water can be heated by a Bunsen burner, and electric hotplate, and a microwave oven.

**Number and Topic:** 2. Measurement  
3. Problem Solving

Source: *ChemMatters*, Dec. 2002, pp. 17-19, "Murder She Floats"

Type of Material: Student Journal Article

Building on: Measurement, problem solving

Leading to: Archimedes' Principle, buoyancy

Links to Physics: Forces

Links to Biology:

Good Stories: Article is a terrific story

Activity Description: Article is taken from "expert testimony" at an actual murder case. A murderer tried to sink a woman's body by placing it in a Styrofoam cooler and dumping it in the ocean. When it wouldn't sink, he shot holes in the cooler. It still wouldn't sink. His brother testified in detail exactly what they had attempted. The prosecution's argument was that if a cooler actually would behave in the detailed manner described by the brother, then the story must be true, since he would never have the technical background to predict the cooler's behavior. He was convicted. The article contains fairly simple calculations about why the cooler would behave as it did.

**Number and Topic:** 3. Problem Solving  
6. Chemical Names and Formulas/Compounds and Elements

Source: *ChemMatters*, Sep. 2001, pp. 14-15, "Global Warming: Hot Topic Getting Hotter"

Type of Material: Student Journal Article

Building on: Basic properties of carbon dioxide

Leading to: Effect of global warming on ecosystems

Links to Physics: Electromagnetic radiation

Links to Biology: Ecosystems

Good Stories: Entire article is a "good story."

Activity Description: The article describes the phenomenon of global warming, both from a theoretical and a measurable basis. It goes on to discuss changes in our atmosphere, possible interpretations of what has caused these changes, and the potential consequences that might be attached to them.

**Number and Topic:** 3. Problem Solving

Source: *ChemMatters*, Oct. 1996, pp. 12-15, "The Crash of Flight 143"

Type of Material: Student Journal Article

Building on: Problem solving

Leading to: Density calculations, importance of units in conversion factors

Links to Physics: Problem solving, metric system

Links to Biology:

Good Stories: Incredibly, Flight 143 crashed because the pilots had to calculate the amount of fuel they needed by hand, since a computer was broken. Using a "conversion factor" without units, they added what they thought was a sufficient amount of fuel. Unfortunately, they had calculated the amount in pounds, when it should have been in kilograms.

Activity Description: Article explains how and why the error occurred and shows the actual calculations that were done and that should have been done.

- Number and Topic:** 2. Measurement  
3. Problem Solving  
17. Water, Aqueous Solutions  
20. Acids/Bases/pH  
21. Organic Chemistry
- Source: *ChemMatters*, April 1994, pp. 10-12, "Swimming Pools"
- Type of Material: Student Journal Article
- Building on: Quantitative calculations, ppm
- Leading to: Acids, bases, pH, organic chemistry
- Links to Physics:
- Links to Biology:
- Good Stories:
- Activity Description: Article discusses the chemistry involved in keeping a swimming pool clean and safe. It does a good job of illustrating the complexity of the trying to balance different requirements that are often in conflict.
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- Number and Topic:** 3. Problem Solving  
7. Moles  
17. Water, Aqueous Solutions
- Source: *ChemMatters*, Dec. 1991, pp. 8-11, "Homeopathy"
- Type of Material: Student Journal Article
- Building on: Problem solving, solutions
- Leading to: Serial dilutions, process of science
- Links to Physics:
- Links to Biology: Placebo effect
- Good Stories:
- Activity Description: Article describes the notion of "Homeopathy," or the use of what are basically infinitely diluted solutions to treat illnesses. While the article contains a lot of good information relating to dilutions, etc., its major value probably lies in its exposition of what constitutes "good science" vs. the claims of pseudoscientific arguments and "scientific experiments" of questionable design.
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- Number and Topic:** 3. Problem Solving
- Source: *ChemMatters*, Oct. 1987, p. 17, "Archimedes"
- Type of Material: Student Journal Article
- Building on: Density
- Leading to: Archimedes' Principle
- Links to Physics: Density, levels
- Links to Biology:
- Good Stories: Story of how Archimedes figured out a way to determine whether a "gold" crown had actually been adulterated with silver.
- Activity Description: Article describes several of the achievements of Archimedes, including his invention of the lever and the discovery of Archimedes' Principle.

## **Flinn ChemTopic Labs**

### **[Order Flinn ChemTopic Labs](#)**

Activity: Rate of energy release by a Bunsen burner, an electric hotplate and a microwave oven

Demo: How Big is a Mole? - Imagining the Mole Activities

Demo: Mole Samples and Molar Mass - Authentic Assessment

Demo: Stoichiometry and Solubility - Mole Ratios and Chemical Formulas

Demo: Stoichiometry Balloon Race - Limiting and Excess Reagents

Demo: Massing Gases—Avogadro's Law

Demo: Molar Mass of Butane—Ideal Gas Law

Lab: Boyle's Law in a Bottle—Pressure versus Volume

Lab: Charles's Law and Absolute Zero—How Low Can You Go?

Lab: Molar Volume of Hydrogen—Combining the Gas Laws

Lab: Technology and the Forgotten Gas Law—Pressure versus Temperature

Webpage: Learning Stoichiometry

## **ICE LABS**

### **[Online Descriptions and Experiments](#)**

No activities for this topic.

## **Technology-Adapted Labs**

No activities for this topic.