ARISE Curriculum Guide

Chemistry: Topic 2—Measurement

ChemMatters

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Articles for Student Use

Element X: Dec. 1987, pp. 8-9.
Matches. Striking Chemistry at Your Fingertips: Dec. 2002, pp. 14-16.
Polywater: Dec. 1987, pp. 10-13.
Robert Bunsen—more than a burner designer: Oct. 1984, pp. 14-15.
Tapping Saltwater for a Thirsty World: Oct. 2002, pp. 4-7.

Articles for Teacher Use

Element X: Dec. 1987, pp. 8-9.

Flinn ChemTopic Labs

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Demo: Acid in the Eye – Safety
Demo: A Burning Candle - Observations
Demo: Classifying Matter
Demo: Flaming Vapor Ramp—Safety Demo
Lab: Observation and Experiment - Introduction to the Scientific Method
Lab: Separation of a Mixture - Percent Composition
Lab: What is a Chemical Reaction - Evidence of Change
Lab: Common Gases—Physical and Chemical Properties
Lab: Preparing and Testing Hydrogen Gas—A Microscale Approach
Lab: Carbon Dioxide - What a Gas—Microscale Gas Chemistry

ICE LABS

Online Descriptions and Experiments

Number and Topic:	**2. Measurement**
Source:	ICE Laboratory Leadership
Type of Material:	Lab 3. Measurement and Uncertainty
Building on:	2. Measurement
Leading to:	3. Problem solving. 8. Chemical reactions. 18. Reaction rates and

	kinetics.
Links to Physics:	Building on same topic taught in Physics
Links to Biology:	Enzymes, metabolic rates
Good Stories:	
Activity Description:	Everyone deals with measurements every day. We hear statements such as "The time at the tone is **10 p.m**." "It is currently **79 degrees** and sunny." "**7.82 gallons** of gas - That will be **$8.60**." The measured values in these three statements are printed in boldface type. Are these and other measurement always exact? An exact measurement is a perfectly correct value containing no error. Right now, before you begin this activity, select the one statement below you think is most correct. A. Measurements are exact if correctly done. B. Measurements may or may not be exact. It depends who did them and how they were done. C. There is some inexactness in every measurement. To study the nature of measurement and gather data which will help determine whether statement A, B, or C is most correct; to determine whether matter is conserved.

Number and Topic:	**2. Measurement**
Source:	ICE Laboratory Leadership
Type of Material:	Lab 18. Searching for the Copper Ion
Building on:	2. Measurement
Leading to:	3. Problem solving. 8. Chemical reactions. 18. Reaction rates and kinetics.
Links to Physics:	Light
Links to Biology:	Enzymes, metabolic rates
Good Stories:	
Activity Description:	To learn how a spectrophotometer can be used to determine the concentration of a colored solution. Volumetric or gravimetric determination of ions can be quite complicated and time-consuming. At times ion concentrations are too low to be determined with accuracy. When this occurs chemists will consider using an instrument that measures the quantity of light energy that is absorbed by dissolved ions as light is passed through the solution. A colorimeter or spectrophotometer can be used as the tool to determine the concentration of these solutions. If the ions do not produce an intensely colored solution they can sometimes be converted to complex ions that are brightly colored, absorbing light in the visible range. A typical example is Cu2+ ion which is converted to the intensely colored Cu(NH3)4 2+ ion by addition of concentrated aqueous ammonia NH3(aq). The percent transmittance at various concentrations is collected and graphed to determine the concentration of copper (II) in an unknown solution.

Technology-Adapted Labs

Number and Topic:	**2. Measurement** **17. Water, Aqueous Solutions**
Source:	*ChemCom*, Fourth Edition, Unit I, Section A, Lab Activity A.2, p. 8.
Modified by:	Bill Grosser, Glenbard South High School
Type of Material:	Lab: Purifying Foul Water (with an inquiry twist)
Building on:	An introductory lab to start the chemistry year
Leading to:	Dissolved ions, physical properties, writing formulas
Links to Physics:	Boiling points, distillation
Links to Biology:	Organic materials are among those removed in this activity.
Activity Description:	This is a great example of how some minor changes to a lab along with the inclusion of technology can turn a terrible lab into a favorite engaging activity for students.
The original lab:	This is the first lab activity done in the ChemCom course. The purpose of the lab is to purify a sample of water contaminated with oil, coffee grounds, dirt, dissolved salt and garlic.
Topics introduced:	Measurement techniques, percent calculations, data analysis (mean, median, range, histograms), density, solubility, conductivity, distillation
Modifications:	The original lab did most of the thinking for the students. The instructions consisted of 24 steps for the students to follow to "correctly purify" the water sample. The instructions were changed to one simple task: Purify this sample of water. Success will be judged on three criteria: 1. Percentage of original sample recovered as pure 2. Conductivity of the sample 3. Clarity of the sample Students design and document their own purification techniques. After each purification procedure, students use technology to quantitatively measure their progress.
Technology used to Enhance Instruction*:*	Vernier probes change this from a qualitative lab to aquantitative lab. A Vernier conductivity probe measures the conductivity of samples after each student purification technique is employed. A Vernier turbidity meter measures the clarity of samples after each step in the process. These tools greatly enhance the lab by making comparisons between samples easy. Posting class data on a spreadsheet, and using a simple scoring system along with the spreadsheet enables us to come up with a definitive "winner" for the class. Deciding how to weight each category is an important part of the learning process for the students. **It should also be noted that this type of technology inclusion could be done with a single computer in the classroom** (a situation that unfortunately is often defined as a high-tech classroom). In this instance it can be a powerful tool!