



**A Schmahl Science Workshop**  
**Chemistry Workshops Catalogue**

- **Acids and Bases**  
Students perform seven experiments: reacting metal with acids and producing hydrogen in safe quantities, collecting and safely testing hydrogen, reacting carbonates with acids and producing carbon dioxide, collecting and testing carbon dioxide, observing the effects of acids and bases on indicator dyes, measuring the concentration of acids by titration of an "unknown," and performing a neutralization experiment.
- **Agilent Afterschool To Catch A Thief: Introduction to Paper Chromatography**  
Students to use their investigative and problem solving skills to solve a crime. Using paper chromatography the students reveal the underlying composition of the four suspects' pens and, utilizing the same scientific process on the ransom note, they identify the criminal. At the end of the session a second crime is provided as a take-home activity.
- **Air and water**  
Students learn that air takes up space and has weight. They learn about some basic principles about pressure and discover how pressure and temperature differences cause air to move. Students learn that the wind that transports pollutants in the air and dilutes the pollution on the way. Knowledge of wind speed and direction can help you calculate in which direction pollution will travel and how much they will mix with the unpolluted air.
- **Analysis of Simple Mixtures**  
Chemistry is the study of the structure of matter and the changes or transformations that take place in it. Learning about the makeup of substances gives us knowledge about how things go together and how they can be taken apart. Learning about changes in substances is important for several reasons: changes can be controlled to produce new materials; changes can be used to give off energy to run machines. During this workshop, students learn fundamental ideas of chemistry: mixture, solution, concentration, saturation, and reaction.
- **Aspirin: Salicylic Acid Extraction from Willow Bark**  
Salicylic acid derivatives have been used as remedies for reducing fever and relieving aches and pains since ancient times. They are found naturally in many plants including white willow and wintergreen.
- **Calorimetry**  
Students construct a calorimeter and use it to determine the heat of solution of 2 salts and the heat of neutralization. This lab exercise introduces students to endothermic and exothermic reactions and the relationship between heat and temperature.
- **Canned Foods and Corrosion**  
Materials that have highly desirable thermal properties also tend to be highly reactive (and vice-versa). Materials that are highly reactive tend to have chemical reactions with other substances around them. A good example would be iron, which tends to react with oxygen to form iron oxide or,

as we commonly know it, rust. Students use fresh fruits and vegetables to extract pigments that are sensitive to iron and tin. Color changes in the presence of metals offer insight into the chemistry of oxidation-reduction reactions and its application to the shelf life of preserved foods.

- **Carbohydrates**  
Students learn about the sources of carbohydrates and their uses in the food industry. Students use pectin in conjunction with an acid and sugar to form jelly. By varying the sugar concentrations, the students observe that there is an optimum ratio for the creation of this spreadable gel.
- **Chem Cubes™: Elements Game**  
Our Chem Cubes Game will teach students the names and chemical symbols of common metallic and nonmetallic elements, use of the periodic table, and writing of simple chemical equations.
- **Concrete Chemistry: Mixtures and Aggregates**  
Concrete surrounds us. When we walk to school, take the bus, walk into a building, or cross a bridge, concrete is there. This program was developed to help students understand how concrete is a key material in our world. It's an exciting material that is more than just rock and sand. Read on to see just how cement and concrete affect our lives. During our workshop, students work on cement and concrete projects...separating out ingredients of concrete, varying the proportions of water and concrete, mixing additives, checking for temperature changes, finding the pH, and learning about this product.
- **Conductivity of Metals: Electrical**  
Students test materials a variety of easy to find solid materials in a circuit to determine whether they serve as an electrical conductor. Students make hypotheses about each item and discuss the results in teams and as a class.
- **Cool Fountains, Tornadoes, Bubbles and Bags**  
Who would have guessed that you could have this much fun with soapy water and a chunk of dry ice? Fill a tall glass or plastic cylinder with warm water and add a squirt of liquid dish soap like Dawn or Joy. Use gloves or the tongs to place a piece of dry ice into the soapy water. Get ready for a room full of ooohs & ahhs! Who would have guessed that you could have this much fun with soapy water and a chunk of dry ice? Fill a tall glass or plastic cylinder with warm water and add a squirt of liquid dish soap like Dawn or Joy. Use gloves or the tongs to place a piece of dry ice into the soapy water. Get ready for a room full of ooohs & ahhs!
- **Countertop Chemistry: Pancakes, Marshmallows, Alka Seltzer**  
Students use simple ingredients to see the states of matter as they change from liquid to solid. They are also encouraged to pay attention to the chemistry in everyday cooking. Chemistry is the study of matter and its changes. Many of the changes that occur in cooking can be considered a form of chemistry.
- **Crushing Eggs**  
Eggs are easy to break, right? I mean the checkout person at the supermarket always puts the eggs

on top of your other groceries. Each dozen is carefully packaged with the special cardboard box to prevent breaking. And you know what happens when you accidentally drop a raw egg on the kitchen floor. A big mess. In some situations, egg shells really are very delicate and "breakable." But in other ways, the shell is a pretty strong structure. For instance have you ever tried to break an egg by squeezing it in your hand, applying equal pressure on all sides of the egg? Go on try. It's harder than it sounds! But hey, sometimes you have to break a few eggs to learn more about science, right? Nature has come up with the egg shape to be light and strong. The egg must be durable enough to withstand the impact of falling on the ground when the chicken lays it.

- **Crystals: Gum Drop Models** Students build models of crystals using gumdrops to demonstrate the internal ionic structure of minerals and how the internal arrangement of ions is reflected in the crystal shape of the mineral.
- **Determination of Vitamin C** Vitamin C is in orange juice, broccoli, and Flintstones chewable vitamins. Students use titration methodology to determine if there is more Vitamin C in a strawberry or a tomato?
- **Early Explorers and Classification: Spices** An introduction to the important spices, their botanical origin, and economic importance.
- **Electroplating: Oxidation and Reduction** Students experiment with the bonding behavior of elements through electroplating (the art of producing metallic coatings by using electric currents.) Economically, metallic coatings are used to improve appearance, resist corrosion, or improve hardness. Examples include plating steel with copper, nickel, or chromium in the automotive industry; tin plated steel for food cans; and the manufacture of silver or gold.
- **Element-O: Periodic Table Board Game** This game makes learning chemistry fun! Students learn many chemistry concepts such as the configuration of the periodic table, physical characteristics of the elements, and the application of elements to everyday life.
- **Elements, Compounds & Mixtures 1** Students separate mixtures by solubility difference, gravity filtration, paper chromatography, and evaporation to discover the differences between elements, compounds, and mixtures.
- **Elements, Compounds & Mixtures 2 - Separating Mixtures** Students study the nature of chemical and physical change and learn how to detect chemical changes by the formation of precipitates, evolution of gases, and color changes in chemical reactions.
- **Experiments in Electrochemistry** In 1791 Luigi Galvani discovered electrical activity in the nerves of the frogs that he was dissecting. He thought that electricity was of animal origin and could be found only in living tissues. A few

years later, in 1800 Alessandro Volta discovered that electricity could be produced through inorganic means. In fact, by using small sheets of copper and zinc and cloth spacers soaked in an acid solution, he built a battery - the first apparatus capable of producing electricity. Naysayers were quick to predict that electricity would never serve a useful purpose. Obviously they were very wrong. Electricity has a central role in our lives and to this day Electrochemistry is a standard course of study. Students apply concepts relating to electrochemistry by constructing a fruit-powered battery. This workshop is designed to compliment/reinforce discussion of concepts regarding electricity and chemistry (e.g., ions, electrolytes, voltage, & batteries).

- **Fun with Chemistry**

Before we can discuss food chemistry, the students must understand basic chemistry concepts. The periodic table of the elements is the grand, unified theory of chemistry. With hands-on activities we introduce our students to The Periodic Table. We also present the Table as a landscape, with fields of metals, pools of mercury and bromine, clouds of gases, and the offshore island of rare earths.

- **Fun with Foams**

Many of us are so accustomed to foams that we hardly notice how odd they are. Foams are on our legs or faces when we shave, on our dishes as we wash them, and on top of our glasses of soda. We explore the exciting physics and chemistry of foams as we blow up marshmallows, create whipping cream, play with bubbles and bake sponge cake.

- **Garden To Dye For**

Students grow plants that are commonly used to make dyes. In addition, by cultivating native plants we are able to attract butterflies and other insects that were used by the Ohlone Indians in dye making. We believe that our students are able to use the study of natural dyes as a powerful research and educational tool. As an added benefit, as our young people learn to manipulate the dyes as we introduce them to the techniques and principles of organic chemistry.

- **GEMS: Filtering and Sifting**

Students sort by particle-size a sand-and-bean mixture whose elements can be sifted and separated. Each student is given a mini garbage dump (actually a cup containing salt, sand, metal, and wax) and challenged to separate the contents using acquired knowledge and the tools and techniques they have practiced in the previous activities. Along the way, the children discuss their work in the significant, real-life context of recycling and the environment.

- **Green Cleaners**

Baking soda to clean sinks and vinegar remove the tarnish from your silverware? Students learn chemistry as they make environmentally friendly household cleaners. They learn some basic knowledge of chemistry: pH, Acids, Bases, Water-Soap, and Surface Tension.

- **Heat Conductivity of Metals**

So, how does heat make it from the burner at the bottom of your pan through to the other side and into the food? The answer is: *Conduction*. Though not necessarily decisive, knowing how well a

material conducts heat is the first step in making a cookware choice. At this workshop, students perform experiments that will determine the heat conductivity of aluminum, brass, copper, iron and stainless steel. This knowledge is essential for selecting the appropriate pots, pans, and skillets used primarily on the stovetop, where heat-up speed and responsiveness to temperature changes can be critical and uniform heating is essential for preventing hot spots that burn food before it's entirely cooked.

- **How Does Water Move?** Through hands-on activities students learn about the components of Earth's hydrosphere, especially the surface and subsurface features; and prepare a diagram to illustrate the path of his or her drinking water from the place of precipitation to the tap.
- **How Heat Flows—Investigating Heat and Temperature** An integrated approach to the study of heat and temperature. Through hands-on experimentation, investigate heat concepts such as convection, heat capacity and orientation to the sun. Apply these concepts to energy transfer in relation to the construction and maintenance of a home.
- **Human Senses: Chemistry of Flavor** The taste buds on the tongue are, of course, important for the flavor of food. Students will learn if different parts of the tongue are most sensitive to different characteristics of food (i.e., salty, bitter, sour, sweet). Does what you see influence what you taste?
- **Iodine Clock** Students learn about rates of reaction, concentration, and oxidation states of iodine, by mixing two solutions and watching for color changes. By recording the time it takes for reactions to occur, students grow to understand controlling variables and kinetics.
- **Ionic Interactions** Through mixing cations with the salts of anions and studying the interactions, students learn to write ionic formulas and equations. They also see how solubility principles are developed on the basis of empirical evidence.
- **Just Add Water** Its ooey, gooey, amazing water magic guaranteed to get ooohs & ahhs! Students perform incredible scientific acts with amazing polymers that defy the laws of nature. Cause a glass of water to magically change into a mountain of erupting snow using Insta-Snow™ powder. Perform the amazing Three Cup Monté trick. Make water disappear only to reappear in the form of a slimy gel. Uncover the "secret ingredient" in baby diapers and learn how to use this non-toxic polymer to conserve water in a garden. Capture a rainbow of color in a test tube. Just add water and be amazing!
- **Kitchen Chemistry** Students perform experiments that examine the ductility and elasticity of bread dough, the effect of moisture on the strength of popcorn kernels, and the chemistry of baking soda in pancakes, biscuits and cookies. Students also examine the denaturation of milk proteins using lemon juice.

- Lipids**

In this experiment, acetone is used to extract the invisible fats, since lipids are sparingly soluble in water but soluble in organic solvents. When the extraction is complete, the students see, touch, and smell the lipid in the Petri dishes and determine if it contains saturated or unsaturated fatty acids. The cocoa butter found in chocolate chips is a saturated fat and will be solid at room temperature. The oils used to fry the potato chips are unsaturated and will be liquid at room temperature. The oil from the sunflower seeds also is unsaturated and will be liquid at room temperature.
- Liquid Classification Game**

A great way to introduce young students to the properties of liquids. Activities include classification, observation, and experimentation; one activity supports discussion of oil slicks and other environmental issues.
- Liquid Investigations: Oobleck**

A team of explorers have just returned from the planet Oblickus in the galaxy Whermi. They have brought with them samples of a substances they are calling Oobleck, and Gloop. At this workshop, you and your partners are part of a team of scientists who have been given the job of investigating the Oobleck, and Gloop so that they can be described to the rest of the world.
- Liquid Investigations: Swirling Colors**

A water/air interface is an interface between two fluids where the higher-density fluid (water) is a liquid and the lower-density fluid (air) is a gas. This liquid/gas interface is extremely familiar to us. The surface of a pond, a glass of water, or the ocean are common examples. A water/air interface is "Rayleigh-Taylor unstable" when the high-density fluid (water) is above the lower density fluid (air). A drop of food coloring glides gently through a glass of water, making beautiful streamers and swirls of color. However, if you add drop of food coloring to a glass of salt water - the color patterns you will see are totally different! In this activity, students have an opportunity to observe, record, and compare the patterns of color made in various liquids. They discover that some liquids that may appear the same are actually very different.
- Liquid Nitrogen**

Liquid Nitrogen is an extremely cold, liquefied gas. It can be used to demonstrate lots of interesting effects from superconductivity to the properties of gases & liquids, and a whole lot more! We use liquid nitrogen to investigate how cold temperatures affect materials. We also discuss the phases of matter and how the Kinetic Theory of Gases models these phases.
- Material Science-Solids**

Students observe and describe the properties of wood, clay, and plastic, metals (copper, steel, zinc, and brass). Students investigate the causes of failure for various materials. How and why do things break? How do engineers decide what materials to use in their designs?
- Mole Rockets**

Students fill Beryl pipettes with mixtures of hydrogen and oxygen, and igniting the mixture turns the pipette into a tiny rocket. Students adjust the ratio of oxygen and hydrogen to find out what

ratio gives the biggest bang. This models the importance of Stoichiometric balance of fuel and oxygen in automobile engines.

- **More Liquid Investigations: Slime and Gloop** Students discover a weird goop that acts as a solid and a liquid made from cornstarch. They compare it to rubber made from white glue and Boraxo (GAK). This relates to mixtures, solutions, chemical reactions, non-Newtonian fluids, viscosity, and elasticity.
- **Mythbusters: Soda Myths** It's the Real Thing, it Adds Life, and You Gotta Have It, but that can or bottle of cola can also work wonders in an emergency. The chemical soup that makes up most commercial soft drinks not only makes them taste good and quench thirst, but also make them effective cleaning agents, bolt looseners, paint strippers, and possible skin softeners. More uses than MacGyver could think up. And since most kids usually have a can or six lying around the house, knowing what to use it for when trouble arises can save you big problems and big money.
- **Nitrogen Cycle** Through hands-on activities students learn how soil bacteria play in providing nitrogen for plant growth via the nitrogen cycle.
- **Parachute Design Challenge** Leonardo da Vinci said: "If a man is provided with a length of gummed linen cloth with a length of 12 yards on each side and 12 yards high, he can jump from any great height whatsoever without injury." A simple parachute will land a small payload-but how big a canopy does it take to bring Barbie back down to Earth? We'll be making parachutes out of facial tissues-but testing some larger ones and their 'carrying capacity."
- **Periodic Kingdom Story** In The Periodic Kingdom, we outline the general features of the chemical elements in the world, their history, and the characteristics and distinctive personalities of these elements, which are the substances from which everything tangible and material is made. We introduce students (who need no prior knowledge of chemistry) to the general features of the table, the history of the elements, and the arrangement which underlines the table in terms of the structure and properties of atoms. We also talk about the elements as finely balanced personalities, with quirks of character and distinct, but not always obvious, dispositions. As a result, the periodic table becomes a kingdom and a land of intellectual satisfaction and infinite delight.
- **Physical Properties Of Matter: Density** Students discover the idea of density as a mathematical concept. Students determine the mass and volume of 48 density specimens, and graph the results. The data is not random, but shows a clear linear pattern with a slope characteristic of the material used. The slope is called the density of the substance. The samples will also be used for testing students' measuring abilities, and as samples of industrially important materials.

- **Play and Freeze Ice Cream** We don't need electricity; just add ice and rock salt in one end and ice cream mix in the other end- then have a ball as you shake it, pass it, shake it and roll it. After 20 minutes, the Play & Freeze Ice Cream Maker delivers 473 mL (a pint) of really great ice cream. So, the next time the kids scream for ice cream, they can have a ball making their own.
- **Preschool: Air Moves** Students learn the basic qualities of air as they experiment with Bernoulli bags, straws and flow density chambers.
- **Preschool: Solids** Students explore properties of solids, such as shape, hardness, and elasticity.
- **Proteins** Students precipitate casein from milk using an acid. This method is used to make cottage cheese. In Part 2, the students will coagulate casein from milk using an enzyme. This method is used for making cheese. In Part 3, students coagulate soy protein from soymilk, using magnesium sulfate. This method is used to make tofu.
- **Sink and Float** Students predict whether various objects will sink or float, then testing their predictions, and classifying objects into two categories. Of course, students want to do some additional, less structured explorations as well. Rest assured that what may seem like "just playing" is valuable, direct experience that can yield important lessons.
- **Sorting By Attributes** Our young scientists practice sorting and classifying in this activity that uses a variety of easily found objects: caps, fabric scraps, plastic or foam shapes, and marbles. Scientists classify and sort objects and phenomena to help analyze commonalities and differences and increase understanding. For example, zoologists and biologists classified animals by form and traits (e.g. - hot or cold-blooded). Today, scientists use DNA analysis (specifically, mitochondrial DNA) and other methods to create "trees of life" that illustrate interrelations amongst species. Object classification requires active decision-making and observation skills. As with other skills, ability increases with practice. Providing multiple opportunities to sort and classify varieties of objects will help students become more comfortable with the process.
- **Sticking With Adhesives** We will learn how to glue objects together using everyday materials and household supplies.
- **Stoichiometry Balloon Races: Limiting and Excess Reactants** Most Stoichiometry calculations in the classroom are performed using exact (Stoichiometric) mole ratios of reactants and products. In real life, however, many commercial processes for preparing compounds are carried out using an excess amount of one reactant (and thus a limiting amount of another reactant). This demonstration uses the well-known reaction of sodium bicarbonate and

acetic acid to illustrate the concepts of limiting and excess reactants. By comparing the amount of carbon dioxide generated when varying amounts of sodium bicarbonate react with a given amount of acetic acid, students will be able to identify immediately the limiting and excess reactant in each case.

- **Testing For Aspirin**

In this workshop, students determine the percentage of aspirin found in single tablet samples of aspirin they bring from home as well as that of the included "Brand X". They also discoverer what other substances besides aspirin are in the tablets and calculated the cost per table.
- **The Stoichiometry of Cooking**

What is the definition of Stoichiometry? Stoichiometry is using molar mass to calculate the gram amount of reactants needed in order for a product to form. How important is it to add the correct amount of reactant in order for a reaction to occur? Students observe chemical reactions as they bake cupcakes. They try to predict what may happen if they vary the amount of reactants that they put in the cake. This relates to chemistry, because if you don't add the correct amount of chemical reactants before the reaction, the product might come out different, or the reaction might not occur. We look at the different cake batters and how they are different. The "mole" of the reactant, in the batter of one group, will be different than the "mole" of a reactant in another.
- **The Stoichiometry of S'Mores**

Students explore the principles of Stoichiometry by building S'mores, the delicious, chocolate, marshmallow, and graham cracker treats.
- **T-Shirt Chromatography**

Chromatography is a technique used to separate mixtures. Many different science fields use chromatography. The technique is used in environmental studies to detect pollution in water and air. Chromatography also is used by crime laboratories to identify clues such as blood, ink, or other substances found at a crime scene. In this workshop students create their own colorful T-shirt design while learning about chromatography. Students separate the ink from permanent colored markers to make a rainbow of colors on your T-shirt!
- **Water Filtration**

Separate a mixture of several substances using physical properties.
- **Water's Surface**

Students investigate one of the special properties of water: surface tension.