Chemistry Workshop Descriptions

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.

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 will 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.

Acids and Bases - For thousands of years people have known that vinegar, lemon juice and many other foods taste sour. However, it was not until a few hundred years ago that it was discovered why these things taste sour - because they are all acids. The term acid, in fact, comes from the Latin term *acere*, which means sour. While there are many slightly different definitions of acids and bases, in this lesson we will introduce the fundamentals of acid/base chemistry. Students will 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.

Liquid Nitrogen and States of Matter - 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 will be using liquid nitrogen to investigate how cold temperatures affect materials. We will also be discussing the phases of matter and how the Kinetic Theory of Gases models these phases.

Pancakes, Marshmallows and Alka Seltzer - In this workshop, students will 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.

Agilent Afterschool: Ooblek, Slime and Gloop - 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 Ooblek, and Gloop so that they can be described to the rest of the world.

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 you will create your own colorful T-shirt design while learning about chromatography. You will separate the ink from permanent colored markers to make a rainbow of colors on your T-shirt**!**

Heat Conductivity of Pan 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 will 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.

Conduction: Air Moves - Using our flow density demonstrator, solar wind bag and singing pipe, students will learn that hot air rises and cold air sinks and how this principle is put to use in a conduction oven. Students won't believe their eyes as they explore the powerful properties of air as you put marshmallows to the pressure test. Students will be challenged to use Bernoulli's Principle to blow up an 8-foot long bag. With a little practice they will be able to inflate the bag using only one breath!

Density and Slope - 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.

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? In this workshop students are going to observe chemical reactions as they bake cupcakes. They will 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 will 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.

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 denaturization of milk proteins using lemon juice.

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, your children will 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. Observing the Rayleigh-Taylor instability of food coloring and water enables the student to discover other characteristics of this flow pattern. Also, the student may observe some of the beauty and wonder of fluid dynamics. These flows appear complicated, but they are composed of only a few basic shapes. These basic shapes occur again and again during the same flow. More advanced studies of these flows have been used to investigate the scientific distinction between order and chaos.

Biochemistry

Principles of Gel Filtration: This workshop introduced gel exclusion chromatographic separation of dyes of different colors on the basis of their size and shape. This workshop contains materials for dye separation which include dye sample, elution buffer and plastic disposables.
Purification and Size Determination of the Green (GFP) Fluorescent Protein*:* Green fluorescent protein (gfp) was isolated and cloned from the jellyfish *Aequorea victoria*. This protein gives a characteristic green fluorescent glow under long UV light. It has effectively been used as a tag to follow the localization and function of proteins in cells. In this workshop, the unique fluorescent property of gfp was used as an assay during its purification from an E. coli extract. Column fractions which contain gfp were identified by green fluorescence.

Microscale Enzyme Catalysis Using a Recombinant Enzyme*:* Genetically engineered microorganisms can produce increased amounts or improved enzyme products. In this experiment, recombinant B-galactosidase is used in colorimetric microscale reactions carried out in microtiter wells. The enzyme reactions are rapid and can be visually quantitated. This workshop was useful as an introductory enzymology experiment for our biochemistry workshops.
Testing For Vitamin C: Vitamin C is in orange juice, broccoli, and Flintstones chewable vitamins. Students used titration methodology to determine if there is more Vitamin C in a strawberry or a tomato?
Testing for Aspirin: In this workshop, students determined 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 discovered what other substances besides aspirin are in the tablets and calculated the cost per table.
Aspirin Synthesis 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.
What is Osmosis? During this workshop, students will work with a selectively permeable membrane to learn about osmosis, diffusion, and water potential of cells with one comprehensive lab activity.