**Fall 2014 Saturday Science- Grades 5-8**

**Lesson 1: Introduction to Chemistry**

**Objectives**: Define chemistry, define matter, define *atoms,* learn about how to study things that we can't see with naked eye

**Activity 1.** What is matter?- students explore various types of matter (liquid- water, solid- wood block, gas- balloon). By weighing and taking volume of these different types of matter they discover that matter takes up space

**Activity 2.** Cutting paper- students explore that matter can be divided into very small pieces by attempting to cut a paper in half as many times as they can. They are asked to hypothesize if there is ever a point where matter can't be divided anymore- the level of the atom

**Activity 3.** Rutherford's Black Box- students will explore how scientists learn about things they can't see, in particular the atom, by observing a demonstration. The demonstration consists of shooting nerf darts through a box that has a model of an atom inside. Students hypothesize that where the dart bounce off is the location of the model. The demonstration replicates the way that Rutherford discovered the nucleus of the atom.

**Activity 4.** Protons and Electrons- students will learn about charges of electrons by making a stream of water move with static electricity. Balloons and pipes are rubbed to create the charge which repels water.

**Activity 5.** Glowing water- students discover more about the amazing thing that electrons can do by observing tonic water light up under a black light. The class discusses that this is caused by the movement of electrons.

**Wrap-up and Assessment**: Discuss the topics learned for the day. Ask students to define chemistry and atoms.

**Lesson 2: Elements and Molecules**

**Objectives:** Define elements, define periodic table, explore the properties of elements, define molecule, show that many molecules together can form a polymer.

**Activity 1.** Exploration of Elements- students will explore samples of elements provided in element kits and they will watch a short video (<https://www.youtube.com/watch?v=0rJmILZ8Psc>), to get acquainted with the properties of elements. They will then choose one element of their choice and conduct independent research on that element. Groups will present to the class the atomic number of their element and some properties of the element. This should include a photo.

**Activity 2.** Helium- students will explore a property of an element by exploring why helium makes our voices go higher

**Activity 3.** Flubber- students will explore the concept of polymers by creating their own polymer.

**Wrap-up and Assessment:** Have students explain the chemistry concepts used to create their flubber.

**Lesson 3: Reactions**

**Objectives:** Define chemical reaction; discover what evidence indicates that a chemical reaction has occurred (temp, gas, solid, light, color change); endothermic vs exothermic, discuss catalysts

**Activity 1.** Exploration of Reactions- students will explore reactions, specifically looking for evidence that a reaction has occurred by looking for temperature changes, creation of solids, color change etc. Reactions include the following: hydrogen peroxide and yeast, hydrogen peroxide and sugar, water and calcium chloride, water and baking soda, vinegar and baking soda, vinegar and salt. Students will fill out a chart to determine which mixtures resulted in chemical reactions and will classify each as endothermic or exothermic.

**Activity 2.** Elephant toothpaste- students will learn about more evidence of reactions using a more dramatic example. Elephant toothpaste results in an intense explosion of foam when soap, hydrogen peroxide, and yeast are combined.

**Wrap-up and Assessment:** Have students explain what evidence they have that reactions are occurring in their elephant toothpaste.

**Lesson 4: Acids and Bases**

**Objectives**: Define acids and bases; learn about pH scale; learn about indicators for pH

**Activity 1.** Dry ice demonstration- when mixed with cabbage juice, dry ice will change colors dramatically as the CO2 released changes the pH.

**Activity 2.** pH investigation- students will explore pH and indicators by finding the pH of common household items. They will use three methods to explore pH: test strips, a computer device, and cabbage juice which changes color based on pH.

**Wrap-up and Assessment**: Have students explain how they were able to measure pH using cabbage juice, have them define the term indicator

**Lesson 5: Forensic Chemistry**

**Objectives:** Learn about how chemistry can be used in real-life applications. Specific concepts include fingerprinting, color tests, pH, chromatography.

**Activity:** In this final session, students are asked to solve a "real" criminal investigation. In a classic "who-done-it" they will use clues and the chemistry they have learned all semester to find out who stole the rare museum artifact. A crime-scene is set-up outside the classroom and students are taken to see the scene and collect evidence one group at a time. The evidence includes a coffee filter with numbers written on it, a mysterious white powder, and fingerprints. Students will compare the evidence from the crime scene with samples taken from each four different suspects. Samples from the suspects include pens, white powder, and fingerprints. Students will develop fingerprint samples from the crime scene to compare with suspects, they will perform reaction tests to see which white powders match the samples from the crime scene, and they will perform a chromatography test to see which pen wrote the note left on the floor.

**Wrap-up and Assessment:** Have students discuss the chemistry behind all these techniques at the end of the investigation and how they were able to determine the culprit.