**Grade level: 9- 12th Subject: Chemistry Date: 10-31-2013**

**Lesson title: Review of chemical reactivity and exothermic reactions**

**Learning objectives:**

* Students will better appreciate the concept of chemical reactivity in science
* Conversions between amounts of reactants and amounts of products using stoichiometric coefficients
* Calculations of the amount of product/reactant given another amount of a substance in the same reaction

**Background:** Chemical reactivity is encountered in everyday life and it is important in preventing and managing disasters as well as heavily used in the making of weapons.

**Safety precautions:**

* Wear gloves and safety glasses at all times
* Do not get too close to the reactions as heat is evolved in the reactions
* 30% hydrogen peroxide is corrosive

**Vocabulary:** Combustion, decomposition, boiling point, vapor pressure, heat capacity, exothermic, flammability, catalyst, activation energy

**Materials needed for lesson:**

 Demo 1: Paper burning experiment

* Piece of paper and a dollar bill
* Matches or lighter
* Lithium, sodium and potassium chloride salts (to get colored flames)
* 95% alcohol
* Methanol
* Water

Demo 2: Elephant toothpaste experiment

* 30 % hydrogen peroxide
* Potassium iodide as a catalyst
* Liquid soap
* Water

**Introducing lesson:** Attention grabber: Two balloons will be deflated. One will produce and explosive sound and the other will be less explosive. The lesson of chemical reactions will begin.

**Instructional Procedure: Sequence for presentation of lesson**

1. Equations of chemical reactions of group 1 metals (Li, Na, K, Rb, Cs etc) with water and accompanying videos will be presented.

Lithium + H20 lithium hydroxide + hydrogen

Sodium + H20 sodium hydroxide + hydrogen

Potassium + H20 potassium hydroxide + hydrogen

Rubidium + H20 Rubidium hydroxide + hydrogen

 Questions will be asked on the trend of the reactivity of the different metals and the students will be engaged in the discussion

Important points to emphasize

* The reactions get more dramatic as you go down the group
* The activation energies decrease as you go down the group and hence the reactions are faster
* The metals become more electropositive going down the group and this increases the rate of reaction
* Hence the reactions are dramatic because they happen faster with the more electropositive metals
1. Combustive chemicals common to our live will be introduced. The burning of natural gas for heating.

 Methane + oxygen carbon dioxide + water

Related to methane is a class of compounds called alcohols. Ethanol and methanol are very common and engage in combustion reactions. Methanol and ethanol are used in cars.

Methanol + oxygen carbon dioxide + water

Ethanol + oxygen carbon dioxide + water

*The first demo will be done and the students will record their observations and also do it themselves.*

*Procedure:*

* Prepare the alcohol and water solution. Mix 10 ml of water with 10 ml of 95-100% alcohol
* Add any of the following salts: NaCl, LiCl or KCl or other colorant to the alcohol/water solution, to help produce a visible flame
* Soak a dollar bill or piece of paper in the alcohol/water solution so that it is thoroughly wet
* Use tongs to pick up the bill. Allow any excess liquid to drain. **Move the damp bill or paper away from the alcohol-water solution.**
* Light the bill or paper on fire and allow it to burn until the flame goes out.
1. Decomposition reactions using the elephant toothpaste demonstration as an illustration of the concept:

Points to note:

* It is a decomposition reaction in which hydrogen peroxide is decomposed or broken down to water and oxygen
* It is a catalytic reaction with potassium iodide acting as the catalyst
* The reaction is exothermic meaning energy is released
* *The second demo will be done and the students will record their observations*

*Procedure:*

* Pour ~50 mL of 30% hydrogen peroxide solution into the graduated cylinder.
* Squirt in a little dishwashing detergent and swirl it around.
* You can place 5-10 drops of food coloring along the wall of the cylinder to make the foam resemble striped toothpaste.
* Add ~10 mL of potassium iodide solution. Do not lean over the cylinder when you do this, as the reaction is very vigorous and you may get splashed or possibly burned by steam.

**Closure and Assessment:** There will be a homework assignment on the elephant toothpaste demonstration.

Background Knowledge Assumed

Students can balance chemical equations and can work with the following relations:

 moles = $\frac{mass}{molar mass}$

moles = $\frac{molecules}{Avogadro^{'}s number}$

density = $\frac{mass}{volume}$

**Extra time plan:** The hydrogen peroxide demo could be done using increasing amounts of hydrogen peroxide or catalyst to gain more insight on their effects on the reaction.