ECCI 5724
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Inquiry into Consumer Products

Introduction: Domestic and foreign sales of chemicals and their related products produce almost $300 billion dollars in the United States, annually. Many chemicals serve as raw materials for plastics (propylene), fertilizers (Nitrogen, Sulfuric Acid), antifreeze (Ethylene), paper (Lime) and soaps (Sodium Hydroxide). They also have very simple chemical compositions and are found in and around our own homes!

Purpose/Rationale: The purpose of this lesson is for students to recognize different consumer products, found in and around the home, that have reactive/denaturing properties when used together. Students will explore chemical and physical properties of each product by identifying chemical formulas and balancing chemical equations, investigating reaction rates, enzymes and activation energy, understanding the structure and function of macromolecules and densities of liquids. Students will create and observe each experiment, using the 5-E Model.

SOL's:
CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include safe use of chemicals and equipment

CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for theinvestigations of chemical and physical properties

CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include balancing chemical equations writing chemical formulas (molecular, structural, empirical, and Lewis diagrams) reaction rates and kinetics (activation energy, catalysis, degree of randomness)

BIO.3 The student will investigate and understand the chemical and biochemical principles essential for life. Key concepts include the structure and function of macromolecules the nature of enzymes

PH.7 The student will investigate and understand properties of fluids. Key concepts include density and pressure

Materials and Resources:
(Exp. 1):
1 large bowl or container
black pepper
1 bar of soap
water

(Exp. 2):
Hydrogen Peroxide (H_2O_2)
2 packages of fast-rising yeast
1 package (2 tablets) of Alka-Seltzer
3 wooden sticks (popsickle sticks)
1 book of matches
75 mL H_2O
2 75 mL beakers

(Exp. 3):
2 plastic cups
50 mL Ethanol (CH_3CH_2OH, simple nail polish remover)
50 mL H_2O
4 simple packing peanuts: 2 figure "8", 2 cylindrical

(Exp. 4)
150 mL graduated cylinder
50 mL whole milk
50 mL light corn oil
50 mL blue lamp oil
1 bottle of red food coloring

Safety: Safety goggles and safety aprons should be worn when lighting matches. Students should waft the Ethanol, as the fume is very strong.

Resources:
Brown, LeMay and Burnsten. Chemistry: The Central Science. Prentice Hall. Upper Saddle River, New Jersey. 1997.

Fox, Marye Anne and Whitesell, Jmes K. Organic Chemistry. Jones and Bartlett Publishers. Sudbury, Massachusetts. 1997.

Srpan, Cam. Consumer Chemicals Lab-Procedures (lab sheet). Roanoke Valley Governor's School for Science and Technology.

Procedures:

1. The teacher will engage the students by demonstrating the discrepant soap and black pepper experiment. To begin, the teacher will measure students' prior knowledge about surface tension, cohesion, liquids, temperatures and polarity of water molecules. An extension of this could be to ask students questions about buoyancy and gravitational pull within liquids, namely water. After the demonstration, the teacher will engage the class in a discussion about surface tension and cohesion. This can be done as a hands-on engagement experiment because it is very easy to observe.

2. Students will explore the reactants and products of different household items, when mixed together. They will hypothesize about what they think will happen between Hydrogen Peroxide (H2O2) and yeast and how that reaction is associated with energy and the consumption of Oxygen and Carbon Dioxide. Finally, the students will write the chemical formulas for both reactions and balance them.

3. Students will first hypothesize about what will happen when both types of packing peanuts float on top of water and Ethanol. They will then do the experiment and explain what happens, in terms of the monomers of certain macromolecules (assume the students know what monomers and polymers are).

4. Students will extend their knowledge about chemical aspects of household items by completing a physical experiment involving density, mass and volume of different liquids.

Students will provide the following evidence for understanding:

Performance Criteria	**Evidence**	**Points**
TSW explain surface tension and cohesion and give examples.	Active in class discussion about soap and pepper experiment.	
TSW demonstrate writing and balancing chemical equations using reactants and products.	Completion of activity sheet involving writing chemical equations.	
TSW be able to discuss the monomers and polymers of specific macromolecules and why they are important.	Completion of activity sheet involving explanation of macromolecules and their properties.	
TSW explain the difference in densities of certain liquids and why.	Completion of activity sheet involving why different liquids have different densities.	

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Consumer Products Activity Sheet

Purpose: In this activity, you will investigate different consumer products by completing discrepant events.

Engage:

Soap and Black Pepper:

Materials: one large bowl, water, black pepper and a bar of soap.

1. Fill the bowl with water. Sprinkle some pepper in the bowl on top of the water. Using a bar of soap, gently make contact between the end of the soap and the middle of the water. What do you think will happen? (class discussion).

2. After completing the activity, what did you observe?

3. Why do you think this happens?

Explore:

Re-light and Burn-out:

Materials: Hydrogen Peroxide (H_2O_2), 2 packages of fast-rising yeast, 1 package (2 tablets) of Alka-Seltzer, 3 wooden sticks (popsicle sticks), 1 book of matches
75 mL H_2O and 2, 75 mL beakers.

1. Fill a beaker with 25 mL Hydrogen Peroxide. Fill another beaker with 25 mL water.
2. Add a few drops of yeast to the beaker containing the Hydrogen Peroxide.
3. With a wooden stick, stir continuously until bubbling has stopped.
4. **Put on your safety goggles.** Light a match and burn the end of a wooden stick until the tip is orange.
5. Blow out the flame and submerge the glowing end of the stick in the beaker with the yeast. (Do not submerge *in* the liquid mixture, just inside the beaker)!
6. What happens? Why?

7. Drop one tablet of Alka-Seltzer in the beaker containing water.

8. As it begins to bubble, submerge the lit wooden stick in the beaker, (again, do not submerge *in* the liquid mixture, just inside the beaker).
9. What happens? Why?
10. What is the chemical equation between yeast and Hydrogen Peroxide? Alka-Seltzer and water?

Explain:

Nuts about peanuts!

Materials: 2 plastic cups, 50 mL Ethanol (CH_3CH_2OH, simple nail polish remover), 50 mL H_2O, 4 simple packing peanuts: 2 figure "8", 2 cylindrical.

1. Fill one plastic cup with 50 mL Ethanol. Fill another cup with 50 mL water.
2. Place each of the peanuts in each liquid: 1 figure "8' and 1 cylindrical in Ethanol, 1 figure "8" and 1 cylindrical in water.
3. After 5 minutes, what has happened? Why?
4. What is a macromolecule? What are carbohydrates made of (polymers)? What are their properties?

Elaborate:

Layering:

Materials: 150 mL graduated cylinder, 50 mL whole milk, 50 mL light corn oil 50 mL blue lamp oil, 1 bottle of red food coloring.

1. Drop a few drops of red food coloring in the corn oil (since it is oil, the coloring wont mix on its own, so stir vigorously.)
2. Fill a graduated cylinder with 50 mL blue lamp oil.
3. Fill the same graduated cylinder with 50 mL light corn oil.
4. Fill the rest of the graduated cylinder with the milk.
5. What happens? Why?

6. Why do different liquids have different densities?