

The Chemistry That Surrounds Us
From Lunchbox to Landfill: How everyday decisions affect the health of our planet.

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“Yes, I am the Lorax who speaks for the trees, which you seem to be chopping as fast as you please. But I'm also in charge of the brown Bar-ba-loots, who played in the shade in their Bar-ba-loot suits and happily lived eating truffula fruits. Now, thanks to your hacking my trees to the ground, there's not enough truffula fruit to go 'round!”

Quoted from The Lorax by Dr. Suess(1)

Synopsis

How can a Sixth Grade Student affect change in the environment? How does chemistry relate to ecology and stewardship of our planet? Why does how I pack my lunch matter to Mother Earth? These are just a few of the questions I would like my students to consider as we journey through our unit “From Lunchbox to Landfill: How everyday decisions affect the health of our planet”. This unit will encourage students to consider their impact on our planet and how to affect positive change through simple actions. This unit is taught through ecology objectives with a chemistry undertone. Students will create biodegradable and non-biodegradable polymers and compare their observations to how these products effect our environment. Students will investigate chemical reactions through hands-on laboratory activities and multi-media demonstrations. The observance of these reactions will emphasize the importance of recycling efforts and waste reduction. Students will further explore this concept through the design and creation of a plastic ware alternative in our Edible Plates lab. By incorporating chemistry into the sixth grade science classroom, curricular rigor is increased and vertical planning is maximized in that students are exposed to content beyond our standards and given the opportunity for enrichment.

Overview

The sixth grade science curriculum is partially an extension of fifth grade content. Thus is true with our Ecology unit. Often students claim, “We learned this last year.” I know

that they haven't exhausted the ecology objectives based on a general pre-assessment I administer in response to these claims. However, I don't want my students to feel that they are simply repeating material learned in fifth grade. I want to challenge my students academically and also encourage them to take a responsible view of their effect on our world. Incorporating chemistry content into our Ecology unit will increase student interest and create a rigorous environment through which my children can develop and exercise their role in environmental stewardship. Students will participate in research based learning stations and hands-on activities to study chemical reactions, create and differentiate between polymers and design an alternative to plastic plates.

I will also incorporate children's literature into the Ecology unit through reading and discussing the books Brother Eagle, Sister Sky by Susan Jeffers and The Lorax by Dr. Seuss. Both of these books stress the impact humans can have on our environment and offer consequences for environmental irresponsibility. I will use the premise offered in these books to establish the basis for our study of chemical reactions and as a motivation for creating the edible plates. Maybe we'll even save a Bar-ba-loot or Truffula tree along the way!

Rationale:

I plan for this unit to last approximately three weeks taught on an A day B day schedule. Students will use this time in directed instruction, independent research stations, and hands-on activities. Students will culminate with the creation of an edible plate made from edible or compostable materials that could replace typical plastic or paper service ware. I intend to incorporate literary strategies and a variety of literature resources into my hands-on science classroom. This year I will also implement the National Common Core Standards for Math and Language Arts. The Language Arts Common Core standards are broken down into standards for Literature, Reading and Writing. These national standards are expected to be represented in all content areas. The Reading and Writing Standards will be used during my unit as I expose students to a variety of fiction and nonfiction reading sources. These will include but are not limited to, children's picture books, research articles, scientific journals and popular magazines such as *Current Science* and *National Geographic Kids*. Using literature in the science classroom will provide interest and demonstrate relevance of reading skills in all curriculum areas. Common Core math standards will be integrated throughout the unit as students use math skills to compute ratios and quantities during our hands-on labs such as GLOP and OOBLECK. Students will also further develop process skills during individual learning stations and laboratory activities. The use of chemistry in sixth grade

will allow for increased rigor as I incorporate the Common Core standards into my classroom.

Introducing chemistry through our Ecology unit will allow students to experience basic content in a non-threatening manner. Students typically are first exposed to chemistry in eighth grade. However, in response to my school's goal to increase rigor within the classroom and teach objectives that are aligned with the previous and subsequent grade, I feel that teaching everyday chemistry at the sixth grade level is appropriate. Students are taught ecology in fifth grade with sixth grade objectives delving more deeply into the specifics of soil formation and how soil health impacts humans. By including chemistry concepts in sixth grade, the rigor level is increased and the possibility of content repetition is reduced. Sixth graders are environmentally conscious and I am anxious to capitalize on that enthusiasm with chemistry instruction. This unit will focus on action at the student level. My hope is to incorporate chemistry content along with the idea of environmental responsibility. The activities during this unit will allow students to incorporate their knowledge of ecosystems and our environment into creating a plan of action.

School Background:

I teach at Carmel Middle School which serves over 1000 students in grades 6-8. Geographically, the school is located in an affluent suburban setting of Charlotte, NC in the Charlotte-Mecklenburg School District. 35% of our students qualify for free and reduced lunch. We are a racially diverse school of approximately 21% African American, 56% White, 14% Hispanic, 4% Asian, and 3% other students. 82% of our 8th grade students scored at or above grade level on the Science EOG according to the Charlotte Mecklenburg School Report for 2009-2010 school year(2). Our school is fortunate to have an active PTSA and exceptional parental support. I teach sixth grade science on a rotating A day B day schedule. I teach the same lesson to six different classes over the course of two days. My classes are a heterogeneous group of students of varying abilities and science backgrounds. I create differentiated activities within the content objective to meet the diverse educational needs of my students.

My science curriculum is based on the North Carolina Standard Course of Study with consideration given to the 2009 Science Essential Standards expected to take effect during the 2012-2013 school year. I pace my school year according to the CMS yearly pacing guides. Activities are chosen that will create an inquiry based science experience for my students. Most lessons are interactive and are divided into teacher input, guided practice or additional investigation, independent practice or group inquiry activity,

explanation of results or investigation and finally additional questions or ideas to explore. I incorporate the use of a SmartBoard and video clips from Discovery Education, PBS, You Tube, and National Geographic on a daily basis. I have access to four computers in my classroom and students use the computer lab often throughout the year for additional research or web activities. My students travel outside to investigate our environment as it relates to our curriculum. I engage students by including hands-on activities, labs, and/or investigations during most class periods.

Content Objectives:

NC Standard Course of Study Goal #3 states: The learner will build an understanding of the geological cycles, forces, processes, and agent which shape the lithosphere.

Objective 3.05

Students will analyze soil properties that can be observed and measured to predict soil quality including color, horizon profile, structure, consistency, texture, particle size, pH, nutrient balance, etc.

Students will collect and analyze soil samples from our school campus. Students will test the soil pH with indicator strips and then introduce household chemicals and pollutants. Students will predict how the quality of these samples will be affected by the new substances. Students will re-test the pH. This process and material availability is described during classroom activities and the lab report is included at the end of this unit. Students will then use classroom computers and provided reference materials to research the feasibility of each soil as a plant medium. Students will also offer possible solutions for plant incompatibility.

Objective 3.06

Students will evaluate ways in which human activities have affected the Earth's pedosphere and the measures taken to control the impact.

Students will participate in a lunchbox makeover. I will present a Ziploc bag filled lunchbox and engage students in a discussion of how this lunch could be packed differently. This will be described in detail during classroom activities. I will share "Trash Facts" with students and allow them to hypothesize as to this lunch's impact on our environment. Students will design a more eco-friendly lunchbox with their team.

Objective 3.08

Students will conclude that the good health of environments and organisms requires

monitoring of the pedosphere, taking steps to maintain soil quality and stewardship of land.

Students will investigate the biodegradability of matter and how this affects our soil during waste disposal. I will present a demo showing a Styrofoam cup that floats in water and then a cup placed in acetone which will dissolve in the solvent. This will introduce a teacher made PowerPoint on simple polymers and chemical reactions. This will provide background information for student investigations and a teacher demonstration featuring chemical reaction experiments. Suggested student research and investigation activities are discussed during the instructional strategies section of this unit. Students will hypothesize as to how these chemical reactions affect our pedosphere and what steps can be taken to lessen the negative affects.

NC Standard Course of Study Goal # 7 states: The learner will conduct investigations and use technologies and information systems to build an understanding of population dynamics.

Objective 7.04

Students will evaluate data related to human population growth along with problems and solutions such as waste disposal, food supplies, resource availability, etc.

For this objective students will participate in an inquiry lab where they will be provided with materials with which to create an edible plate or bowl. Students will work to brainstorm possible materials that could be used to create this product as well as possible uses. Students will use classroom computers to research background information on the use of edible plates. The goal will be to create a product that is, if not pleasing to eat, at least biodegradable or compostable in a speedier fashion than current products available. Students may consider the use of their product as animal feed or compost, not just for human consumption.

During this unit I also plan to address the following 2009 Essential Science Standards:

Objective 6.P.2.1

Students will recognize that all matter is made up of atoms and atoms of the same element are all alike, but are different from the atoms of other elements.

The inclusion of the Essential Standards will create a unit more focused on the direction of science instruction within CMS. These objectives will add relevance to the incorporation of chemical decomposition and composition of everyday objects. Students

will create OOBLECK and compare this to other liquids and solids. Students will create a checklist as to how this material acts as a solid and as a fluid. Students will write an argumentative essay stating their opinion. OOBLECK will demonstrate physical change. Students will later compare this to GLOP which represents a chemical change.

Objective 6.P.2.2

Students will explain the effect of heat on the motion of atoms and molecules through a description of what happens to particles during a change in phase.

Students will refer to our experiments depicting chemical reactions. Students will make a physical model of chemical reactions using adhesive and non-adhesive materials. Students will observe how some bonds are stronger than others and discuss how variables can affect the bond.

Students will create a simple polymer called GLOP(also called Flubber or GOOP). GLOP is a mixture of Borax and white glue which maintains its composition and integrity over a period of time. Food coloring may be added to create different colors which provide a basis of material identification. Students will be able to create the GLOP and investigate how this represents a chemical change. Students will also examine the biodegradability of this polymer. Students will hypothesize as to how this affects our pedosphere. As a follow-up activity, students will differentiate between the OOBLECK created previously and the GLOP. Students will compare and contrast their characteristics through the use of a Double Bubble Thinking Map.

Instructional Strategies:

As an introduction to my unit ***“From Lunchbox to Landfill: How everyday decisions affect our planet”***, I want my students to establish a learning focus for our unit of study. This unit will be part of our overall Ecology study and will be based in sixth grade Ecology objectives with a chemistry undertone. The chemistry activities and background information will create increased rigor and student interest. To create excitement for our unit, I will show various illustrations and pictures depicting the “Great Pacific Garbage Patch”(3,4). This area of plastic debris located in the Pacific Ocean has become of great concern to scientists and environmentalists worldwide. I feel that it is important for students to have a personal goal when learning new content. To accomplish this, students will complete a **KWL** chart. Students will begin by establishing a list of what they **K**now about the topic of chemistry. After class discussion, students will establish a set of learning goals addressed in the What I **W**ant to Know section of the **KWL** chart. This list of questions or statements will provide students with a focus for their learning. Upon

completion of the unit students finish the chart by listing what they have Learned. This graphic organizer provides students with insight as to their initial learning goals and provides an informal assessment addressing whether those goals were met. I find that students are more motivated to investigate content when they have established meaningful individual learning goals.

To facilitate instruction of objective 3.06, I will engage students in a Lunchbox Makeover activity. Students will view a teacher created PowerPoint featuring “Trash Facts”(3,4) about the Great Pacific Garbage Patch. This will provide visual stimuli and background knowledge so that my students will understand the basis for the lunchbox makeover. For this activity I will present a lunchbox packed from home. This lunch will be the DON’T version of a self-packed lunch in that it will be in a plastic grocery sack with individual servings packed in Ziploc bags and using products with excessive packaging in their design. As I present this lunch, students will discuss the appropriateness of the items with their learning team. Learning teams are table groups established to foster collaborative learning and cooperative work ethic. Students are grouped based on behavioral and academic needs and strengths. Students maintain these teams throughout the unit and will evaluate each other at the end of each major group activity. As they view the lunch students will respond to various thought-provoking questions in their interactive notebook. This activity will help establish background information and elicit student understanding as to how their everyday decisions affect our Earth. From this dialogue we will establish what our concerns are for our world and how we can affect change as students. Some possible inquiry questions are as follows:

- What could be done to improve the environmental friendliness of this lunchbox?
- What do you think happens to all of the trash from this and other lunches?
- Can plastic breakdown in landfills and how does this affect our Planet’s health?
- How does human activity, intentional and unintentional, change nature’s course?

I plan to integrate a variety of literature into this Ecology unit. Students will participate in a read aloud of the Susan Jeffers picture book Brother Eagle, Sister Sky(5). This book is a fictional adaptation of a speech supposedly given in the mid-1850s by Chief Seattle of the Northwest Indian Nations in response to the Government’s desire to purchase the lands of his people. The words of Chief Seattle were transcribed by Dr. Henry Smith, a friend of Chief Seattle’s. This transcription has been rewritten more than once and the exactness of the words is not the concern. The message is meant to inspire environmental awareness and understanding that in our desire to build and progress, we may lose everything. The first lines of Jeffers book state “How can you buy the sky?

Chief Seattle began. How can you own the rain and the wind?" The basic concept that Earth is not ours to use and destroy but ours to respect and tend will be the underlying thread of consciousness of my unit. I want to encourage my students to see their place in the world as one of caretaker and not one of ownership. Students will participate in an Agree, Disagree, or Not Sure debate about environmental concerns that arise after reading the book. This quick evaluation of student thoughts will further organize the direction of this unit. By introducing the unit through the lunchbox makeover and then addressing how ecological awareness has changed over time, I will create interest and relevance for my students. This book also lends itself to Objective 3.06. The incorporation of literature directly addresses the goals of our National Common Core Standards. These standards require that students interpret a variety of text throughout the disciplines. Fictional literature centered on environmental awareness will provide a common focus for instruction. Common Core Reading Standard (R1.6.8) states that students are expected to examine and evaluate the argument and specific claims in a text, distinguishing claims that are supported by evidence from claims that are not proven. Using a variety of literary sources will allow development of this standard. Students will also write an argumentative essay addressing their position on a specific environmental issue created by our discussion of Brother Eagle, Sister Sky. This essay will include a position statement and various evidentiary points to substantiate the argument. Common Core Writing Standard (W.6.1) requires students to write an argument supported by claims with clear reasons and relevant evidence. Taking a stance on an environmental issue important to them will motivate students to research and write an argumentative paper supported by evidence. This essay will serve to develop Common Core Writing Standard (W.6.1). By introducing the unit through the lunchbox makeover and then addressing how ecological awareness has changed over time, I will create interest and relevance for my students.

Early into the unit I will also read the book and/or show the video The Lorax by Dr. Seuss. This children's book provides great insight about taking care of our Earth and how modern conveniences can harm our ecosystems and destroy native animals and plants. This book, quoted at the beginning of this draft, will provide the catalyst to introduce soil health and the discussion of biodegradable polymers and how product toxicity affects humans. I will use this book to facilitate the soil sample activity and introduction of chemicals discussed in Objective 3.05. Students will collect samples around our school campus and test the soil pH using Hydrion pH test strips ordered from Fisher Scientific. Students will follow a teacher created lab activity based upon a more complicated lab from Forestry Suppliers, Inc (6). Students will work with their learning

team to explore this lab and complete an investigations report. This report will serve as an assessment of student understanding. A copy of this lab can be found at the end of the unit. The Lorax will also encourage the discussion of environmental pollution and how an object's chemical composition affects its ability to breakdown over time. This will lead into our Styrofoam decomposition demonstration and discussion of everyday polymers and chemical reactions addressed under Objective 3.08. Students will view the video clip "Physical Science Series: Chemical Reactions" on www.discoveryeducation.com. Students will also investigate chemical reactions through on-line research and reference materials. Students will respond to research analysis questions and also complete two experiments exploring chemical reactions. A student activity lab report containing suggested websites, reference materials and experiments is located at the end of this unit. Students will investigate evidence of a chemical reaction and relate those investigations during their hands-on lab activities. I will also present background knowledge comparing physical reactions to chemical reactions which students will relate to previous knowledge of physical and chemical changes discussed during our rocks unit and our weathering objectives. I plan to trigger prior knowledge by referring to this information in the student interactive notebook. I will introduce the PowerPoint on physical and chemical reactions by reviewing the difference between physical and chemical reactions using torn paper, physical change, and burning paper, chemical change. Through this demonstration students will recognize that torn paper can be reconstructed while the burnt paper is permanently changed. After viewing the PowerPoint and video clip, students will record observations and illustrations in their interactive science notebook. I will present a demonstration of "Elephant Toothpaste". This is described in detail during the background section of this unit. Students will then create two different chemical reactions with their learning team. Students will add seltzer tablets to water and record their observations. Students will add baking powder to vinegar and record the results. Students will need to follow proper safety procedure during this activity. Students will discuss what evidence indicates that a chemical reaction has occurred and compare this to a physical reaction. Students will assess the real-world applications for their results.

Students will create and analyze OOBLECK during this unit. OOBLECK is a non-Newtonian fluid which acts as a liquid and as a solid depending on the external conditions. When pressure is applied OOBLECK acts as a solid but runs through one's fingers like water when the pressure is released. Students will examine OOBLECK as an example of a physical change. Students will create a checklist and try to determine whether they think it is a solid or a liquid. Students will then write a short argumentative

paper explaining their stance and decision. This activity and paper will further implement Essential Standard 6.P2.1 and Common Core Writing Standard W.6. OOBLECK is explained further and the recipe given in the activities portion of this unit.

To help students differentiate between physical change and chemical change, students will create GLOP(also known as Flubber and GOOP). Students will also compare the chemical reaction that occurs when GLOP is created to the mechanical change that occurs in OOBLECK. If allowed to dry, OOBLECK will return to basic cornstarch as the water evaporates. GLOP is a chemical change in that it cannot be returned to its original form. GLOP is a material created by combining Borax and Elmer's glue. Food coloring can be added to create different samples for comparison. GLOP will maintain its consistency and new form for a period of time. The creation and study of GLOP facilitates the instruction of Essential Standard 6.P.2.2. Students will test the biodegradability of OOBLECK and GLOP by adding water to them. Students will assess how the properties of each would affect soil health and how these substances relate to real-world situations. Before degrading the materials students will create a Double Bubble Thinking Map comparing and contrasting the characteristics of the two materials.

A final strategy for accomplishing our objectives will be the culmination event. As all students do not come to me with the same Science background it is important that I provide opportunities for science discovery during which students "fill in the gaps" of their science content knowledge. Incorporating chemistry into our study of soil health and human effect on the environment will establish a common ground for my students of varying backgrounds. For objective 7.04, students will participate in an inquiry lab where they will be provided with suggested materials with which to create an edible plate or bowl. Students will research current trends in edible table ware on classroom computers. Students will create a fast fact sheet containing information found on the web. Suggested websites are www.nvyro.com, www.sierraclub.org, www.biotrem.com, and www.potatoplates.com. I will also provide background information based on current research. Students will brainstorm as to possible pros and cons of edible plates and how they can be used in our society. Students will first research the concept of edible table ware. Students will be expected to move beyond the typical waffle bowl or taco shell and create a new product from a starch base such as oatmeal, rice, or pasta and an edible adhesive material such as honey, molasses, or syrup. Students will create and analyze the use of these edible materials. Students will again plan and work with their learning team to create the final product. Students will also research the negative aspects of this product. Is it more expensive to make? Will people use this at home instead of paper or plastic dishware? What are the limitations of the design concept? Students will research

and plan with their learning team on one day and then create the bowl next class period. I will provide materials as well as ask students to bring in possible materials. After creating the bowls and allowing them to dry, we will test their durability. Students will place metal washers on the plate and see how many it will hold before collapsing. We could also test the bowls by placing water on each plate and recording the results. Students will analyze their final product by writing a summary of the activity. Students will discuss motivation behind their chosen materials and design, how their product performed during the durability tests, taste of the product and possible applications to real life use.

By establishing individual learning goals and real-life relevance through the lunchbox makeover activity, I will introduce an Ecology unit rich in chemistry content and concepts. Students will participate in hands-on activities investigating chemical and physical reactions and comparing the characteristics of each. Students will relate this new information to soil health and human impact on the pedosphere fully incorporating our Ecology objectives into the unit. Students will create a final project incorporating new information about environmental issues and chemistry concepts into an environmentally sound product that may have real-world applications. My learning strategies are varied in both presentation and activity. I want to encourage my students to embrace chemistry concepts as they relate to ecology. By implementing the National Common Core Standards in both Math and Language Arts I am providing relevant objective- focused lessons for my students. Incorporating the new National Science Essential Standards with the current Charlotte-Mecklenburg Schools standards will create a comprehensive curriculum rich in both content and opportunity.

Background Information:

Great Pacific Garbage Patch(3,4): *This information will be used to create a teacher-made PowerPoint and used as a unit introduction. Pictures will be incorporated as well.*

- Most of the trash produced in today's society is plastic. Plastic cannot be decomposed by Earth. Except for a very small amount of plastic that has been burned or repurposed, all plastic ever made or used remains on Earth today.
- Plastic accumulates in the ocean into great garbage swills. Fish and other mammals are outnumbered by the plastic 6 to 1. Some have consumed so much plastic and toxic waste that they are unsafe to eat.
- The largest garbage dump in the ocean is known as the Great Pacific Garbage Patch. It is the size of a continent as 3.5 million tons of trash float in this swirl.

- The Great Pacific Garbage Patch is made from the North Pacific Subtropical gyre. This has produced two large masses of trash; the Western and Eastern Garbage Patches.
- 80 percent of the trash in the ocean originates on land.
- Some trash from the Great Pacific Garbage Patch eventually ends up back on land. In Hawaii, there are beaches covered with up to 10 feet of trash while others have “plastic sand” which is millions of tiny pieces of plastic ground down to grain-like sizes.
- The world produces approximately 300 million pounds of plastic each year. 10 percent of that ends up in the ocean and 70 percent of that sinks to the ocean floor.
- Plastic that does decompose or break down in the ocean leaches dangerous chemicals into the water that will negatively affect aquatic life and water quality.

Polymers:

Polymers are large carbon-based molecules formed by repeating chains of monomers joined sequentially. These polymers can be natural or synthetic in composition. Students in this unit will create two different polymers, OOBLECK representing a physical change in matter and GLOP which will demonstrate a chemical reaction. Polymers are created through chemical reactions that bond the monomers together. The creation of a polymer involves making a more complex product from simpler reactants. Polymers can be formed from a single type of monomer strung together or can be the product of multiple types of monomers. Examples of everyday synthetic polymers are plastic and polyester fabric. Naturally occurring polymers include cellulose, starch, and protein.

Chemical Reaction:

A balanced chemical reaction demonstrates the conservation of mass in that no matter how the atoms are rearranged during a chemical reaction, the same number of atoms will be present at the beginning of the reaction and after the reaction occurs. Students will investigate this law during their learning investigations demonstrating chemical reactions. I will begin with a teacher demonstration of “Elephant Toothpaste” during which I will combine food coloring and 6% peroxide with Dawn dish soap. Yeast will then be added to act as a catalyst to release an extra oxygen atom. This reaction will create a large stream of foam that looks like toothpaste. This can be handled with bare hands and manipulated after the foam stops moving. The jar will also be warm to the touch as this is an exothermic reaction. This type of reaction involves the release of energy. Exothermic reactions are also observed through the change in state of matter and the

release of energy through heat energy. 6% peroxide needed for this experiment is available at a beauty supply store. 30% peroxide can also be used and produces a larger display however it must be ordered from a chemical supply company and stored under chemical precautions.

Students will also observe a chemical reaction through the creation of GLOP. Students will observe that when Borax and Glue are combined the molecules join creating a polymer. This chemical reaction prohibits the materials from returning to their original state. Students will further investigate chemical reactions by adding seltzer to water and baking powder to vinegar. Students will work with their learning teams to explore and analyze the results of these activities.

Physical Reaction:

Students will investigate the physical change in matter by creating OOBLECK. This is a non-Newtonian fluid which acts as a solid and a liquid under certain conditions. A non-Newtonian fluid is one that displays increased viscosity when compressed or stirred. Newtonian fluids generally demonstrate increased viscosity when cooled after being heated. OOBLECK combines cornstarch and water until it reaches a paste-like consistency. The material can be compressed to perform as a solid but will slip through one's fingers when the pressure is released. I plan to show a YouTube video clip of individuals running across a pool of OOBLECK several times and then sinking to the bottom after several trips across the pool of OOBLECK. At the end of the video the individuals stop moving and sink. This further demonstrates the properties of OOBLECK. Scientists have long discussed the science behind the properties of OOBLECK(7). Some speculate that the molecular shape of the starch molecule affects its ability to flow like a liquid. When pressed quickly the molecules don't have enough water between them and friction between the starch molecules resists the flow of OOBLECK like a liquid. However when the pressure is released the molecules are able to flow freely thus acting like a liquid. Students will investigate the OOBLECK and create a list of properties. Students will determine if they consider OOBLECK to be a solid or liquid after the investigation.

Classroom Activities:

Introductory Activity:

Trash Facts Discussion and Lunchbox Makeover (Objective 3.06)

I plan to use the Trash Facts as a PowerPoint presentation. Several pictures will be added to excite students and encourage discussion. A teacher demonstration of our trash's impact on our environment will add relevance to the discussion. I will demonstrate how a Styrofoam cup floats and does not dissolve or degrade in simple water. I will then place the Styrofoam cup in a beaker with acetone which will dissolve the cup. Students will draw conclusions about this product's impact on our pedosphere and how products students use affect our environment. This will lead into our discussion of The Great Pacific Garbage Patch and how student's daily decisions affect our planet. I will introduce a student lunch packed with Ziploc bags containing common lunch items; grapes, carrots, cookies, etc. The entire lunch will be packed in a grocery store sack or purchased brown paper bag. Students will brainstorm packing alternatives and design a new lunch using teacher provided catalogs and research sites on classroom computers. Students will also access websites offering storage ware such as Tupperware, Bento, etc. Students will create and share a mini-poster of their new design and respond to written critical thinking questions. An outline of the activity is as follows:

Lunchbox Makeover Activity

From Lunchbox to Landfill: How everyday decisions affect the health of our planet!

Before:

How does the Styrofoam cup demonstration represent the impact of trash on our planet?

What did you notice about the first lunch?

How do you think this lunch will affect the Great Pacific Garbage Patch?

After:

Describe the changes your learning team made to this lunch.

How are these changes more environmentally friendly?

Can you think of other simple changes you could make that would lessen your personal impact on the Great Pacific Garbage Patch? If so, what are they and how would implement them?

Classroom Activity:

Soil Sample Analysis(Objective 3.05)Appendix One

Students will collect samples from our middle school campus. Students will extract a variety of samples by digging at least six inches into the soil and placing the bottom half of the sample into a Ziploc bag. Students will collect samples of varying textures, composition and particle size. Students will note the location of the sample collection on the Ziploc bag. Students will make observations about their soil samples regarding

texture, composition, and particle size and record these observations on the investigation report. Students will place one tablespoon of each sample into a plastic cup and add $\frac{1}{2}$ cup of distilled water. After stirring the samples, students will test their samples for pH using Hydrion pH strips. These can be purchased from Fisher Scientific or found at some hardware stores. Students will record the pH level of each soil sample and then use teacher provided materials and reference books to note which plants and/or crops would be most suitable to each soil type. Students will then add diluted ammonia, Borax, or cornstarch to each soil sample. After adding the substance and stirring the soil solution, students will re-test the pH. Students will make conclusions about soil usability based on their observations. Students will also use written and computer reference materials to identify possible solutions for soil treatment after contamination. Students will use the new pH level later in the unit as they hypothesize as to how the polymers GLOP and OOBLECK will affect soil health and composition. A lab investigation for the soil sample activity is located at the end of this unit.

Classroom Activity:

Chemical Reaction Activities (Objective 3.08) Appendix Two

During this activity I will demonstrate the difference between physical and chemical changes by tearing paper into pieces. I will engage students in a discussion as to how the torn pieces differ from the original paper. Can the paper be put back together and restored to its original form or is it forever changed? I will then burn a piece of paper. This will need to be done outside with proper fire precautions or inside under a ventilation hood. Students will discuss how the burnt paper is different from the initial form. Students will record their observations as evidence that a chemical reaction has occurred. Students will view a video clip from Discovery Education “Physical Science Series: Chemical Reactions” showing various chemical reactions and record additional evidence of a chemical reaction. I will demonstrate “Elephant Toothpaste” as described earlier in this unit. For each of these activities students will record their observations in the science notebook by creating a graphic organizer. Students will illustrate or diagram their observations on the left side of their paper and record factual information on the right side of the paper. This method of organization is aligned with right and left brain hemispheres and processes(8). This background information will prepare students to create their own chemical reactions. Students will perform two investigations and conduct research with their learning teams. Students will respond to these investigations and answer research questions on the lab report located at the end of this unit. Students will combine seltzer tablets and water and record their observations. Students will vary

the method by leaving one tablet whole and crushing the other tablet before adding it to the water(9). Students may also choose to vary the water temperature and record their results. The second activity will involve adding baking powder to vinegar and using the chemical reaction to blow up a balloon attached to a bottle(10). Students will need to follow proper safety procedure during this activity. Students will observe and then compare/contrast these reactions. For each investigation students will respond by recording their results on the attached report and completing analysis questions. Students will indicate evidence that supports or disproves the presence of chemical reactions. Students will relate these reactions to daily products and how their interaction with our environment impacts soil and environmental health.

Classroom Activity:

OUBLECK(E.S. 6.P.2.1)

Materials: newspaper, plastic Ziploc bags, food coloring, cornstarch, water

Recipe: Place 1 cup of cornstarch in the Ziploc bag. Slowly add water to the bag while gently mixing the material. You may add cornstarch or water as needed to create a paste-like consistency.

Students will create and observe the OUBLECK. Students will perform simple tasks with the OUBLECK such as squeezing it into a ball and then releasing the pressure. Students will note their observations as to how the OUBLECK behaves in various situations. Students will compare the OUBLECK to a liquid and a solid as they interact with the material. Students will create a solid vs. liquid checklist and classify the OUBLECK during the activity. Students will select a state of matter to which they believe OUBLECK best fits and then write an argumentative paper supporting their choice with observations from their experiment as evidence. Students will note how OUBLECK is a polymer created by a physical change. If the OUBLECK is left to dry, the cornstarch will return to its original form after the water evaporates. Students will also relate the soil analysis pH testing with the cornstarch to the OUBLECK polymer and how this would affect soil health.

Classroom Activity:

GLOP(E.S. 6.P.2.2)

Materials: newspaper, Borax, Elmer's white glue, Ziploc bag, water, food coloring

Recipe: Pour an 8oz bottle of Elmer's glue in a mixing bowl. Fill the bottle with warm water, put the lid back on and shake, add this to the mixing bowl. Add a couple drops of food coloring.

In a small cup add ½ cup warm water and 1 teaspoon of Borax, stir carefully. Slowly add the Borax mixture into the glue mixture. Use a spoon to stir until it becomes too firm. Now use your hands and get the GLOP completely mixed. If the consistency is not just right, add more Borax or glue water until you like the feel of your GLOP. GLOP can be stored in a Ziploc bag for a period of time and will maintain its consistency.

Students will create GLOP and make observations about its properties. This will facilitate our discussion of polymers and how some cause more adverse environmental effects than others. Students will also refer to the soil analysis and review how Borax affected soil pH and thus soil health. Students will compare and contrast GLOP to OOBLECK by creating a Double Bubble Map. Students will discuss the impact of each polymer on our environment and how this relates to everyday products. To further understand the impact of polymers, students will test the biodegradability of each polymer. Students will record their observations and illustrations in their interactive notebook. The level of biodegradability and how this affects our environment on a larger scale will be explored as well.

Classroom Activity:

Edible Plate (Objective 7.04)

To address the human impact on our environment students will create an organic alternative to plastic ware commonly available. Students will use classroom computers to research materials currently on the market. Suggested websites are listed during the instructional strategies section of this unit. Students will design an edible plate with their learning team using suggested materials and adhesives such as oatmeal and corn syrup or cornmeal and molasses. Students will be encouraged to think of new combinations. The final product will be created after research and design and will be done in class. After allowing the products to dry, students will test the durability of their product using metal washers. Students will also test the solubility of their product using liquid. Students will complete a product analysis and summary after the activity. Students will address positive and negative aspects of their product. Students will discuss the appropriateness of their product either as an edible product or suitability as animal feed.

Throughout this unit my desire is to increase content rigor while exposing my students to enriching activities focused on ecological concerns. “From Lunchbox to Landfill” is not just a title but a level of consciousness that I hope to help my students achieve. By investigating chemical and physical reactions using fun, everyday materials and products students will realize that everything they interact with has a chemical basis and thus an impact on our planet’s health. The use of literature in the science classroom will incorporate common core standards and encourage literacy across the content areas. The interactive activities incorporated into the unit will increase student interest and provide hands-on experiences for students. Students will recognize how chemistry is integrated into their lives and appreciate their place in stewardship over our planet. The introduction of chemistry at the sixth grade level through our Ecology objectives increases content rigor and encourages vertical alignment with standards addressed in later years of middle school. The activities and lessons in this unit will serve to establish and further encourage a sense of environmental responsibility in my students. To quote Chief Seattle, “The Earth does not belong to us. We belong to the Earth.”

Appendix One:

Determining Soil pH and the Effects of Common Solutions

Materials:

- 3 soil samples with different characteristics (ie: Sandy, red clay, top soil)
- pH test strips
- Plastic cups
- Distilled water
- Diluted ammonia
- Borax Laundry Booster
- Cornstarch
- Ziploc bags

Initial pH Steps to Follow:

1. Select 3 different test sites and note the location on the Ziploc bag
2. Dig down 6 inches into soil and place bottom half of sample into the bag
3. Record soil observations regarding texture, composition and particle size.
4. Label each cup to match your soil sample location, add 1 tablespoon soil
5. Add $\frac{1}{4}$ cup of distilled water to each cup.
6. Gently swirl the cup or stir with spoon
7. Place the edge of the pH paper into the mixture and observe the results.
8. Match the pH color to the chart on the Hydrion box and note the pH level.
9. Identify your sample as acidic or basic in nature.
10. Use reference materials to identify plants compatible with each soil type.

11. Record all of your results and observations on the table below.
12. Add two tablespoons of contaminant to the soil; one per sample
13. Repeat steps 5-10 and record your results below.

Soil Sample	Soil description	Site location	pH level: Acid/Base	Plant/Crop Compatibility	Solution Added	Contaminated pH level
ONE						
TWO						
THREE						

Experiment analysis:

How could you treat your soil to make it more compatible for growing tomatoes?
 What did you observe about the soil composition and the pH level? Did you notice a correlation between the two properties?
 How did each contaminant affect the soil samples? How does this relate to products used every day?

Appendix Two

Chemical Reactions Investigations
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Research:

Use the websites and reference materials, research chemical reactions and answer the following questions. You must use at least 4 resources.

www.chem4kids.com www.windows2universe.org

www.youtube.com (MrErrett: Evidence for Chemical Change)

Simple Chemistry Material Matters: Chemical Reactions

Material Changes and Reactions Chemical Change: From Fireworks to Rust

What is a chemical reaction? Physical reaction? Explain the similarities/differences.

What observations serve as evidence that a chemical reaction has occurred?

Explain at least three common chemical reactions that occur in nature.

How do the chemical reactions of everyday product during decomposition affect our environment?

What can you do to minimize these effects?

Investigate:

Perform the following investigations with your team and record your results and observations.

Balloon Blow-up: Reaction Evidence

Materials:

Balloon small plastic bottle funnel white vinegar

Procedure:

- Push the funnel into the neck of the balloon and pour in a tablespoon of baking powder through the funnel into the balloon. Set aside.
- Pour 4 tablespoons of vinegar into the bottle. Stretch the neck of the balloon around the bottle, being careful not to spill any powder.
- Lift the balloon so that the powder falls into the bottle.

Analysis:

What did you observe when you added the powder to the vinegar?

Does this indicate evidence of a chemical reaction?

Why do you think the balloon blew-up?

Drop, Drop, Fizz, Fizz: Rate of Reaction

Materials:

2 seltzer tablets(one crushed, one whole) 2 plastic cups water stopwatch

Procedure:

- Place the whole tablet in a cup, add water. Start the stopwatch immediately.
- Time the tablet until it completely stops fizzing. Record your results.
- Repeat the above steps with the crushed table.

Tablet	Fizz Time	Observations
Whole		
Crushed		

Analysis

What evidence of chemical change did you observe?

Did the condition of the tablet affect the rate of chemical change?

How does this relate to the decomposition of garbage in our landfills?

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