Chemistry: Eating It All Up
Providing Students with the Knowledge and Opportunity to Experience Chemistry Everyday

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Overview

This unit on chemistry is intended to enhance and support the School District of Philadelphia's fourth-grade Science Core Curriculum through the use of food and engaging hands-on investigations. In this unit, students will gain an understanding of what chemistry is and how it can be explored in common household food items and extended to higher order functions through a taste test. This unit will incorporate hands-on learning, cooperative learning, problem-based learning, and inquiry-based science instruction, which all offer means of actively engaging students in authentic scientific problem-solving.

Throughout the nine-lesson unit, students will consider these questions: What is chemistry? How can chemistry be explored in food? What are solutions and mixtures? Why does oil separate from water? What is the effect of salt on melting point? How does chemistry affect how we taste? Why is food sour/sweet/salty/bitter? Why do you only taste things with your tongue? Why does acid taste sour and sugar taste sweet? How does the brain interpret signals from cells?

The main objective of asking these questions is to bring awareness to how chemistry is everywhere by using food and common household items. The unit begins with a basic introduction to chemistry and each lesson builds on the previous as the unit progresses. By the end of the unit, students will have enough knowledge of chemistry to research a chemist who invented a common product and explain the discovery of their invention for their final assignment.

Rationale

Chemistry is an important area of science that is sometimes overlooked until children enter middle school and high school. Chemistry isn't just about beakers and Bunsen burners. Chemistry is the science that helps us learn about the world all around us. Children need to understand at an early age that everything in the world is made of chemicals- the food we eat, the medicines we take, our school supplies, our houses, our pets, and us! Chemicals are the ingredients that make up all living and non-living things.

Elementary students develop scientific understandings of concepts through exploration and demonstration. Chemistry is an area of science that may not be deeply grasped unless given the opportunity for exploration. There is very little chemistry instruction currently in the School District of Philadelphia's fourth grade curriculum and students would benefit greatly from the addition of a unit that incorporated this area of science. Providing ample opportunities for students to physically experience chemistry through hands-on and engaging activities helps bridge the gap between instruction and learning. This unit will look at chemistry for an explanation for everyday things like the food we eat and taste, the iced tea we mix, and the tape we use. It will provide lessons and activities using many household and kitchen items to encourage awareness of how chemistry explains our tastes, how foods are made, and increase knowledge of everyday products that we use.

This unit will be used to enhance and supplement the core curriculum by building student's knowledge of matter, enforcing cooperative learning, encouraging higher level thinking, and incorporating reading, writing, and math. The diversity of the lessons will explain the many different facets of chemistry that exist in our world and appeal to various types of learners.

Background Information on Chemistry

Chemistry

Chemistry is the study of the way materials are put together and their behavior under different conditions. This science, arguably more than any other, involves all of one's senses: seeing, hearing, tasting, feeling, and smelling. According to Janice VanCleave in *Chemistry for Every Kid,* having a foundation in basic chemistry facts can assist one in the study of other scientific curricula. Students will be more easily able to explain future studies in different fields of science with an understanding of chemistry. Chemical concepts can be used to explain many events that we observe daily.

The science of chemistry has been around since the prehistoric times. There were known metals that were recorded and listed in conjunction with heavenly bodies. In 300 BC, Aristotle declared the existence of only four elements: fire, air, water, and earth. At the beginning of the Christian Era, alchemists attempted to transform cheap metals into gold.

All of their efforts proved to fail, but they continued with experiments to find out why. These chemists were the first known people to use what we know as the scientific process. Because of their endeavors, chemistry developed as a science that continues to use this process as an approach to the solution of a problem through experimentation. Throughout this unit, the scientific process will be used to encourage testable questions, develop hypotheses based on what is known, develop an experiment that will test the question, report results, and find a conclusion or continue to ask further questions.

Mixtures

When looking at mixtures, it is often hard to see the different parts because they are mixed as molecules, which are too small to see. However, chemists can figure out what is in things and how those things can change and why. Chemists can investigate and figure out if something is a mixture by separating it into pure substances. It is much easier to tell if something is a mixture when you can see the different parts, like oil and water or a container of varied pebbles. Sometimes a mixture looks like a pure substance and separation needs to happen through mechanical means like filtering or evaporation. Some other ways chemists separate out different parts can be by color, shape, size, density, or the temperature at which they melt or evaporate (Rader, 2014).

Solutions

A solution is a type of mixture where one of the substances dissolves in the other. The substance that dissolves is called the solute. The substance that does not dissolve is called the solvent. They are groups of molecules that are mixed up in an even distribution so that everything in the solution is evenly spread out and mixed together.

There are three different types of mixtures, which are alloys (homogeneous), suspensions (heterogeneous), and colloids (heterogeneous). An alloy is composed of a metal and another element, such as brass, pewter, and steel. A suspension is a mixture between a liquid and particles of a solid, such as water and sand. When the two are mixed up, the sand will disperse throughout the water, but will settle when left alone. A colloid is a solution where very small particles of one substance are evenly distributed throughout another substance, such as milk. Milk is a mixture of liquid fat suspended in water and when left to sit the different parts can be seen. Oil and water is another example of a heterogeneous solution.

The butter making lesson in this unit is one example that will demonstrate what a solution is by separating the “curd” from the “whey” just by shaking the heavy cream in the container. Although the heavy cream looks like an evenly distributed substance, the students will visually and physically recognize how this is a colloid solution.

Dissolve

In chemistry, dissolving is when the solute breaks up from a larger crystal of molecules into small groups or individual molecules. The substance being dissolved is called the solute, which in this unit is salt and sugar, and the substance doing the dissolving is called the solvent, the water. In this unit, students will be dissolving salt and sugar into water. For a liquid to dissolve a solid, the molecules of the liquid and solid must attract one another. The reason the water dissolves salt is because the positive part of water molecules attracts to the negative chloride ions and the negative part of water molecules attracts the positive sodium ions.

The reason that water dissolves sugar is that the bond between the oxygen and hydrogen atoms (O-H bond) in sugar (sucrose) gives the oxygen a slight negative charge and the hydrogen a slight positive charge. This makes it a polar molecule. The water molecules attract the negative and positive areas on the sucrose molecules, which make the sucrose dissolve in water. A liquid that is not a polar molecule, such as oil, does not dissolve a polar substance like sucrose.

Common Misconceptions

There are many misconceptions when it comes to the science of chemistry. Teachers need to be aware of misconceptions prior to instruction so they can be identified and addressed. It is important that these misconceptions are addressed when students are in elementary school before they build on these concepts without correct knowledge of them.

One common misconception that children may have in chemistry is that freezing and boiling are examples of chemical reactions. In the ice cream making lesson, this misconception will be addressed. Freezing and boiling are examples of physical reactions because they are a change of state. Other changes of state include melting, condensation, and sublimation. Energy can be either added or removed from the system in both chemical changes and changes of state.

Another common misconception is that oil and water do not mix because oil and water molecules repel each other. Oil and water do not mix because the attraction between water molecules is greater than the attraction between oil and water. It would require energy for the oil molecules to come between water molecules.

There are also many misconceptions about what happens to salt and sugar when they are mixed into water. Some children may think they simply disappear. However, salt and sugar do not disappear but their molecules are separated and attracted to the polar ends of the water molecule.

Overcoming Misconceptions

Students are going to come into the classroom with prior knowledge, which will guide their understanding of new information. It's crucial for teachers to pay attention to the incomplete understandings, false beliefs, and misconceptions that are brought with students to science class. In order for students to develop understanding in an area of inquiry such as electricity, students must have accurate knowledge, understand the facts and ideas in the unit area, and organize the information and knowledge in a way where it can be applied in other situations. Each of these misconceptions will be addressed in the unit and teachers should make a point to help students overcome them (Aydeniz, 2010).

Objectives

This unit is intended for students in Grade 4. For many teachers, the focus of teaching has primarily become language arts and math with the intent on preparing students for the PSSAs. Too often science is overlooked but it can be an incredible opportunity for students to thrive in their academic endeavors. This unit is designed to incorporate writing, reading, and math, with a focus on chemistry.

The objectives of the unit will include the following:

- Establish a deep understanding for the three states of matter: solids, liquids, and gases
- Understand how water dissolves salt and sugar on a molecular level
- Recognize that salt and sugar are still present in water after dissolving
- Discover how salt and sugar requires mechanical means to separate out once they are dissolved
- Investigate why mineral oil is not good at dissolving sugar
- Discover salt's ability to lower melting point
- Observe different tastes we experience when we eat food (bitter, sweet, sour, salty)
- Examine how the brain interprets signals from the cells on our tongues
- Understand why we only taste things with our tongue

- Explore everyday products that we use that were designed and invented by chemists

- Recognize and explain specific ways that we are chemists every day

Standards

The lessons and ideas presented in this unit are appropriate for fourth grade students studying the concept of chemistry. The lessons provide a basic understanding of chemistry and terms associated with chemistry such as mixture, solution, dissolve, molecules, matter, and chemicals. This unit will provide a framework for further investigation of chemistry including real world applications and chemistry courses in years to come. This unit will help students fulfill the Pennsylvania Academic Standards for: Science, Reading, Writing, Speaking, and Listening. The Standards are listed in the Appendix.

Strategies

This unit will include age-appropriate instruction and materials to gather information about chemistry and the world we experience around us. There will be a variety of activities that will engage students through the use of food and common household items. Students will be verbally and visually instructed with modeling and will be given hand-outs that explain each lesson. The various written and spoken instruction will target a variety of learners. Each student will be aware of what is expected for each investigation. When they gather information, they will create age appropriate graphs at times, respond in their Science Notebooks to the best of their ability (pictures/writing) and other representations to display the collected data. They will also have the opportunity to present their findings verbally during each lesson. This unit incorporates reading, writing, and math (creating graphs, measuring ingredients) as well as a hands-on and communicative approach so that all students' levels and abilities are reached.

Activating Prior Knowledge Through Inquiry-Based Learning

Students come into our classrooms with a range of prior knowledge, skills, beliefs, and concepts that greatly influence how they view and interpret the environment around them. This affects their abilities to remember, reason, solve problems, and acquire new information. Therefore, teachers must pay attention to this prior knowledge and address the false concepts that the students bring with them (Polman, 2000).

In this unit, students are encouraged to ask questions, make predictions, test their hypotheses, and discuss results. In this way, students will be able to witness for themselves evidence of scientific concepts that either support or refute their beliefs. Each lesson is designed to build on the foundation of the previous lesson. The processing lesson is intended to require information learned earlier and combine it with new

inquiries and investigations in order to establish more knowledge about chemistry. This scaffolding will help students develop an accurate and organized understanding of chemistry and associated concepts (Polman, 2000).

Problem-Based Learning

The best way for students to learn science is to experience the problems and try to solve them. To do this, real-world problems are presented for students to investigate what they need to know and want to know. In a problem-based learning environment, students take responsibility for what is learned and how it is learned. The teacher guides the investigations through challenging questions and well-planned lesson structure, but the students use collaboration and inquiry to problem-find, problem-solve, and evaluate results.

Cooperative Learning

This unit will incorporate cooperative learning where students need each other to complete a task and are expected to participate in tasks that are necessary for the group's success. The teacher circulates around the room as a facilitator, but the students carry out their tasks without constant instruction by the teacher. In cooperative learning, all members have the opportunity to make their own contributions, develop respect for all members, problem-solve constructively, and learn from one another.

Hands-On Learning

Students will be given materials to observe, explore, and learn from hands-on throughout this unit rather than the behaviorist method of teaching and learning. While learning facts and definitions is important in any subjects of science, children need to be able to physically apply the information that was taught, specifically in a chemistry unit. They need to understand what happens when certain chemicals are mixed and how this can be observed in every day life. Hands-on interaction will help to accomplish this (Polman, 2000).

Science Notebooks

Science notebooks can be used in the science classroom to help students develop, practice, and refine their science understanding. They can respond to experiments and investigations by organizing their thoughts regarding the new information. Science notebooks also help students enhance their reading, writing, mathematics, and communications skills. They offer many opportunities to develop and enhance students' communication, written, visual, and oral skills. Even students who may have poor writing skills can us observational drawings and graphs to show their learning. Teachers can use these notebooks to guide their teaching and take note of misconceptions and mastery of

skills. They can formatively assess concept development at the students' ability level (Gilbert, 2005).

Classroom Activities

Students will engage in a variety of activities to encourage them to delve deeper into the world of chemistry. These activities are listed below.

Unit Instruction Plan/Lesson Sequence
Unit: 4Th Grade Science **Chemistry: Eating It Up** **Focus for Learning:** Students will gain an understanding of how chemistry is all around us. They will discover how chemistry can be explored and investigated through the foods we eat and the products we use.
Lesson 1: What is Chemistry? **Objectives:** Students will think about what they know about chemistry and what they want to learn about chemistry and discuss it with their group. **Materials:** chart paper, students' science notebooks, post-its, pencils **Questions:** What do you think of when you hear the word chemistry? What do you already know about chemistry? What do you want to learn about chemistry? **Activity:** Students will respond to these questions in their science notebooks. After 15 minutes, they will share their responses with the other students at their table. As a table, they will write down 2 things they know about chemistry on a post-it and 2 things they want to learn about chemistry on another post-it. These post-its will be placed on a class poster that will remain in the classroom during the unit. As students learn new things about chemistry, they will be encouraged to write what they learned on a post-it and place it on the lower half of the poster. **Assessment:** The teacher will observe conversations at tables, ask probing questions to enhance thinking, and use post-its as assessment. **Duration:** 30 minutes
Lesson 2: Exploring Homogeneous Solutions: Water Dissolves Salt and Sugar **Objectives:** Students will measure salt and sugar in water to dissolve it. Students will recognize that the salt and sugar is still present in the water after dissolving, but requires

mechanical means to separate it out. Students will learn how the salt and sugar dissolve in water because of the polarity of their molecules. Students will recognize that mineral oil does not have polar molecules that dissolve sugar.

Materials: sugar, salt, mineral oil, M&Ms, water, containers, measuring cups, teaspoons, science notebooks, pencils

Introduction: Communicate the lesson objectives to the students and review student ideas about chemistry on poster from previous day. Show the materials and ask students the following questions. Have students discuss the questions with their group.

Questions:
What do you think will happen when we add salt to water and stir?
What do you think will happen when we add sugar to water and stir?
What do you think will happen to M&Ms placed in water and M&Ms placed in oil?

Activity: Students will be in groups of 4 and each group will be given 2 containers of water, 1/4 cup of salt, and 1/4 cup of sugar. Students will take turns pouring 1 tsp. of salt into the water and stirring. They will continue pouring additional teaspoons of salt until it no longer easily dissolves. They will do the same thing with the sugar. Then they will draw a picture and answer the observation questions in their science notebooks.

Next, the students will place M&Ms in a cup of water and M&Ms in a cup of mineral oil. They will observe what happens to the sugar coating of the M&Ms in both cups. Students will then draw this experiment in their notebooks with their observations.

Observation Questions:
What happened to the salt and sugar when they were stirred in the water?
Did the salt and sugar disappear?
Can you think of a way that we could separate the salt from the water and the sugar from the water?
What happened to the M&Ms in both of the liquids?
Why do you think the sugar coating on the M&Ms in the water dissolved more than the sugar coating of the M&Ms in the mineral oil?

Review:
The reason that water dissolves sugar is that the bond between the oxygen and hydrogen atoms (O-H bond) in sugar (sucrose) gives the oxygen a slight negative charge and the hydrogen a slight positive charge. This makes it a polar molecule. The water molecules attract the negative and positive areas on the sucrose molecules, which make the sucrose dissolve in water. A liquid that is not a polar molecule, such as oil, does not dissolve a polar substance like sucrose.

Assessment:
The teacher will use observation of each group as assessment. The observation questions will be used to promote thinking and assess learning throughout the lesson. Science notebook responses will be used as assessment of understanding after the lesson.

Duration: 45 minutes

Lesson 3: Separating Solutions: Boiling Salt Water and Making Rock Candy

Materials: salt solution from previous lesson, sugar solution from previous lesson, additional sugar for rock candy activity, 1 clean glass container for each group (ex: clean mayonnaise jar), 1 piece of string, 1 non-toxic weight to weigh down the string in the jar, 1 pencil to tie the string to at the top of the jar, 2 burners, 2 medium cooking pots

Objectives: Students will understand that salt and sugar can be removed from the water. Students will learn how to remove sugar from water by making rock candy. Students will understand how the temperature of the liquid affects dissolving.

Introduction: Discuss the previous day's lesson about solutions. Students will review with their group how the salt and sugar dissolved in the water. The students will then turn to a partner and discuss their ideas for separating the salt and sugar out of the water. Each pair will share their ideas with the rest of their group.

Guiding Questions: What do we need to do to separate the salt from the water and the sugar from the water? If students do not come up with the solution of evaporation, the teacher will prompt them by reminding them about the water cycle and how puddles "disappear".

Activity 1: Over a burner, the teacher will place the heavily saturated salt-water solution into a pan and let it boil. Check on it every few minutes. After the water has all evaporated, the students will see only salt left on the bottom of the pan.

Activity 2: While the salt-water solution is boiling, the teacher will introduce the rock candy activity.
How to Make Rock Candy:
1. Pour 3 cups of sugar and 1 cup of water into pan.
2. Heat the mixture to a boil, stirring consistently. The sugar solution needs to reach boiling, but not get too hot or cook too long.
3. Stir the solution until all the sugar has dissolved.
4. Add food coloring for color.
5. Set the pot of sugar syrup aside to cool.
6. Dip a string in the sugar water and attach a non-toxic weight to the end of it. Place the string into clean glass container so the weight hangs just above the bottom. Tie the cotton string to a pencil and rest it across the top of the jar.
7. Pour the cooled solution into the jar.

8. Place the jar in an area where it will be undisturbed and check on the crystals every day. The crystals will take about 3-7 days before they are ready to be removed, observed, and eaten.

Review: The teacher will show students the pan with the salt-water solution and students will discuss their observations. They will observe how the salt remains in the pan after the water evaporated. Throughout the waiting period for the rock candy, evaporation will be discussed and how the candy crystals are growing will be observed. Students will track the growth in their science notebooks.

Assessment: The teacher will use observation and science notebooks responses as assessment.

Duration: 30 minutes for experiment

Lesson 4: Combining Substances to Make Mayonnaise

Objectives:
Students will learn that oil and water (or lemon juice, in the case of mayonnaise) do not mix without an emulsifier like egg yolk. Students will understand that oil separates from water because the molecules of water are charged- one side is a little positive, the other side is a little negative. The oil is neutral so it doesn't bind. The egg yolk acts as an emulsifier by binding the positive and negative ends of the chemicals.

Materials: 1 cup canola oil for each group, 2 egg whites for each group, 2 tsp lemon juice for each group, spoons to stir, science notebooks, pencils

Activity: Each group will measure ¼ cup of canola oil and ½ tsp of lemon juice to combine and mix. They will observe that the two do not mix well together no matter how long they stir it. Next, they will use the remaining ingredients to make mayonnaise. They will combine the egg yolk and lemon juice first and whisk it constantly while slowing adding ¼ cup oil to the yolk mixture a few drops at a time. Gradually add the remaining ½ cup oil in a very slow thing stream, whisking until the mayonnaise is thick. This process will take about 10 minutes in total. Students will be asked to discuss with the group members how they think this happened and what had to be added to allow the oil and water to mix. Students will draw before and after pictures in their notebooks (before the egg whites, and after the egg whites).

Assessment: The teacher will use observation and science notebook responses as assessment.

Duration: 45 minutes

Lesson 5: Separating a Solution to Make Butter
Objectives: Students will recognize that when you vigorously shake the marbles in the container, you are breaking the membranes so that fat can escape and bond.

Materials: 3 marbles for each group, 1 clean glass baby food container for each group, heavy cream to fill 2/3s of jar for each group

Questions: What happens when you vigorously shake marbles and heavy cream in a baby food container? Will anything change?

Activity: Members in each group will take turns vigorously shaking the marbles in the baby food container that is filled 2/3s with heavy cream. After about 5-10 minutes of shaking, the will begin to see the separation of the oil and water. They will be asked to discuss with their group why this happened and then respond in science notebooks.

Observation Question: Why does the oil separate from the liquid (water)?

Review: The teacher will explain that butter is made by agitating milk or cream. What if it is shaken for a long period of time in this case, the milk fat globule membranes that encase the fats are broken. This causes the fats to clump together, and separate from the buttermilk. So the goal when making butter is to break the membrane so that you can separate the fat from the buttermilk. The teacher can also explain how churns were used to do this in the past.

Assessment: The teacher will use observation and science notebooks responses as assessment.

Duration: 30 minutes

Lesson 6: Combining Substances to Make a Solution: Ice Cream

Objectives: Students will learn that salt lowers the melting temperature. Students will understand that energy can be removed from chemicals to melt something else. Students will understand that it requires heat to get a solid (ice) to melt. They will investigate these changing states of matter and recognize that the ice around the ice cream needs to melt so that it removes heat from the milk.

Materials: For each group: 1 cup half % half or milk, 1 tsp vanilla, 2 Tbsp sugar, 4 cups crushed ice, 1 cup rock salt, 2 quart size zip-lock plastic bags, 1 gallon size zip-lock freezer bag

Questions: How can we combine room temperature substances to create solid ice cream? When you feel like you have a lot of energy, what do you need to do to release the energy? What is the freezing point of water? What is the freezing point of salt water? Is the freezing point of salt water warmer or colder than plain water? What happens when you put salt on ice, like on an icy road in winter?

Activity: Students will answer the above questions with their group. Then they will

follow the following step-by-step instructions.

1. Students will get required materials.
2. Students will pour the milk or cream, sugar, and vanilla into a small plastic bag and seal it. Place inside the second quart-size bag, and seal.
3. Place the double-bagged ingredients inside the gallon-size freezer bag. Fill the freezer bag with ice, pour in the rock salt, squeeze out air, and seal (*The salt will begin to melt the ice because salt lowers the freezing point of water).*
4. Gently shake the bag making sure the ice is evenly spread out. Continue to gently shake and knead the bag in your hands, taking turns with group members (*The energy from shaking and kneading- and the heat transferred from your hands- causes the ice to melt future.)*
5. After about 10 minutes, take a thermometer and find the temperature of the melted ice.
6. Evenly distribute the ice cream between group members in small bowls.

Observation Questions: Did the temperature change from the beginning of the experiment to the end? If so, what caused the change in temperature? If you put 2 ice cube trays in the freezer- one with plain water, one with salt water- which one would freeze first?

Review: Students will know that this was a physical change of state, not a chemical reaction. The teacher will explain that energy needed to be released from the milk in order for it to drop in temperature. The ice from the outside bag caused the milk to lose energy. Although the melting ice did not appear to be as cold as frozen ice, it was mixed with salt and when the melting ice combines with the salt, the salt-water solution has a lower freezing point than plain water. So the melted ice is actually colder than the original ice. Students will recognize that salts makes ice melt. That is why people spread it on icy roads in cold climates. Salt lowers the freezing point of the ice. Water normally freezes at 32 degrees Fahrenheit. Salt water is harder to freeze than plain water. You have to make it colder than 32 degrees Fahrenheit in order to freeze it. That's one of the reasons why a fresh water pond will freeze before one that's mixed with salt water from a nearby ocean.

Assessment: The teacher will use observation, probing observation questions, and science notebooks responses as assessment.

Duration: 45 minutes

Lesson 7: Why Do Foods Taste Different? sour/sweet/salty/bitter

Objectives: Students will taste test each of the foods and distinguish between the different tastes experienced. They will understand that different parts of the tongue are used to distinguish these tastes. Students will explore the chemical reactions that create the different flavors that they experience daily. They will understand how the brain

interprets signals from the cells on our tongues. Students will gain an understanding that every cell in our mouth is exposed to the chemicals that cause taste and why we only taste things with our tongue.

Materials: lemons slices, milk chocolate, salted pretzels, bitter baker's chocolate, picture of labeled tongue, graph paper for each student

Procedure: Students will conduct a taste test using the various foods. They will have a model of a tongue where they will mark where they taste the different foods. They will then create a graph that shows if they liked each food or not and what kind of taste each food had.

Review: The teacher will explain that taste is a chemical sense perceived by specialized receptor cells that make up taste buds. Our brain interprets signals from the cells on our tongues and tells us what chemical we taste.

Assessment: The teacher will use observation, the Tongue Worksheet, and the Taste-Test Graph assessment.

Lesson 8: Who Invented What and How?

Objectives: Students will use the internet, books, and articles to research a chemist who invented a common item or food, made a discovery for the medical field, is currently working to develop something that will benefit a different area of life, etc. They will answer specific questions about the chemist and share the information with the class in an oral presentation.

*** NBC Learn features 21st Century Chemists in the *Chemistry Now* original video series funded by the National Science Foundation. Students may choose to use this series in their research.

Assessment: A rubric will be used to assess the oral presentation.

Duration: Two 45 minutes periods for research, 45 minutes for presentations (adjustments can be made according to class needs)

Lesson 9: "I Am a Chemist" Writing Assignment

Objectives: Students will use what they have learned about chemistry and how it is all around us to write a 3-page paper describing how they are chemists in their everyday life.

Assessment: A rubric will be used to assess this writing assignment (see Appendix A).

Standards

The Core Curriculum of the School District of Philadelphia is aligned to the Pennsylvania Academic Standards for Science. Students will address all of these standards when they complete each lesson. They will be generation questions, using the scientific process to think about conducting investigations, build on explanations, observe the happenings in the investigation, record their findings, and state a conclusion that is consistent with the data that was gathered. These standards include instruction on the following areas:

S4.A.2.1.1: Generate questions about objects, organisms, or events that can be answered through scientific investigations.

S4.A.2.1.1: Use scientific thinking processes to conduct investigations and build explanations observation, communication, comparing, and organizing

S4.A.2.1.2: Design and describe an investigation (a fair test) to test one variable.

S4.A.2.1.3: Observe a natural phenomenon (e.g., weather changes, length of daylight/night, movement of shadows, animal migrations, growth of plants), record observations, and then make a prediction based on those observations.

S4.A.2.1.4: State a conclusion that is consistent with the information/data.

S4.A.2.1.4: Organize and communicate findings

Annotated Bibliography/Resources

Teacher Resources

Steve Spangler Science <http://www.stevespanglerscience.com/lab/experiments/candy-chemistry-experiments>
Website on chemistry experiments and activities

Gilbert, Joan and Marleen Kotelman. (November/December, 2005). Five Good Reasons to Use Science Notebooks. *NSTA Science and Children, 28-32.*
This article provides reasons why science notebooks are beneficial to students.

NBC Learn <http://www.nbclearn.com/chemistrynow/cuecard/52418>
This website describes basic chemistry and offers videos of 21st century chemists.

Polman, Joseph and Roy. D. Pea. “Tranformative Communication as a Cultural Tool for Guiding Inquiry Science.” School of Education, Technology & Learning Center. St. Louis, MO: John Wiley & Sons, Inc. 2000.
This resource provides information about teaching science through inquiry and the benefits of communication.

Science for Kids: American Chemical Society
http://www.acs.org/content/acs/en/education/whatischemistry/scienceforkids.html
This website contains chemistry experiments and information.

Willis, Judy (March 2007). Cooperative learning Is a Brain Turn-On. Middle School Journal, 28 (4): 4-13.
This article highlights the benefits of cooperative learning.

Rader, Andrew. “Solutions and Mixtures.” *Chem4Kids*. Andrew Rader Studios, 1997. May 2, 2014. < http://www.chem4kids.com/files/matter_solution.html>.
This website offers explanations of chemistry concepts for kids.

Student Resources

Brown, Cynthia Light. *Amazing Kitchen Chemistry: Projects You Can Build Yourself.* Chicago: Nomad Press, 2008.
This book has many easy experiments that can be done by kids using household items.

Frith, Alex. *What’s Science All About?* UK: Usborne Publishing, Ltd. 2010.
This is an informative guide to physics, chemistry, and biology. It includes how they work and how they apply to everyday life.

VanCleave, Janice. *Chemistry for Every Kid: 101 Easy Experiments That Really Work.* New York: John Wiley & Sons, 1989.
This book explains the importance of chemistry and breaks it down into simple experiments that are used to teach concepts.

Appendix A

Name: _____ Date: _____

"I Am a Chemist" Rubric

Directions: Using the information you learned throughout this unit, think about how you are a chemist every day of your life. There are many instances throughout our day where we are exposed to chemistry experiences. Describe these experiences and explain specifically how chemistry is incorporated. Be sure to include an introduction and conclusion.

	0	**1**	**2**	**3**
Topic: In what specific way are you a chemist?	Included 0 ways that you are a chemist in your everyday life	Included 1 specific way that you are a chemist in your everyday life	Included 2 specific ways that you are a chemist in your everyday life	Included 3 Specific Ways that you are a chemist in your everyday life
Neatness	No paper was turned in.	The paper was sloppy and	Most of the paper was neat.	Every page of the paper was neat. Student paid attention to neatness.
Length	No paper was not turned in.	A 1-page paper was turned in.	A 2-page paper was turned in.	A 3-page paper was turned in.
Creativity and Understanding	Student did not show understanding of chemistry terms and information.	Student showed inconsistent understanding of chemistry terms and information.	Student showed some understanding of chemistry terms and information.	Student showed consistent knowledge of chemistry terms and information
Final Points: **_____/ 12** **Percentage:** **_____**				