Lesson Identification and Learning Goals

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Lesson Topic: Matter and Its Interactions

Grade Level: 5th

NGSS Performance Expectation:

- **5-PS1-4.** Conduct an investigation to determine whether the mixing of two or more substances results in a new substance.
    - **LESSON FOCUS:** Mixing substances results in a new substance.
- **Sources Used:**
    - HubPages (2012). 5 Hands-On Experiments to Teach Kids About Chemical Reactions. http://sadie423.hubpages.com/hub/hands-on-experiments-to-learn-about-chemistry
    - Science Bob (2014) Fantastic Foamy Fountain (The Elephant's Toothpaste Experiment) http://www.sciencebob.com/experiments/toothpaste.php
    - Youtube (2014). Make Lead Iodide-And the Golden Snow. https://www.youtube.com/watch?v=V_X3Gt3daLs
- **Driving Question for Lesson:** How do substances change when mixed together?

Unpacking the Disciplinary Core Ideas and Related Practices for your Performance Expectation:

CONTENT	PRACTICES	WHY IS THIS IMPORTANT?
PS1.B: Chemical Reactions When two or more different substances are mixed, a new substance with different properties may be formed.	**Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**Crosscutting Concepts: Cause and Effect** -Cause and effect relationships are routinely identified and used to explain change. **Linked Curriculum:** **Articulation of DCIs Across Grade-Levels:** 2.PS1.B; MS.PS1.A; MS.PS1.B **Common Core State Standards Connections:** **ELA/Literacy:** **-W.5.7** Conduct short research projects that use several sources to build knowledge through investigations of different aspects of a topic. **-W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources **-W.5.9** Draw evidence from literary of informational texts to support analysis, reflection, and research **Real Life Applications:** Everything around us is made of matter, and we can mix substances to create new things such as foods, drinks, etc. **Why do the Practices matter?** An investigation will help students visualize a concept that is otherwise very abstract and difficult to conceptualize.
What do students need to KNOW? • A chemical change is when two or more substances are mixed together to form	**What do students need to DO?** • Conduct a hands-on investigation to see what happens when two substances are	**List reasons why it is important for students to study this performance expectation.** • Everything around them is made of

something new. • The new substance has different properties. • Four main clues that a chemical change has occurred: 1.) Formation of a gas (Look for fizzing/bubbling) 2.) Reaction causes heat, light, or odor to be emitted 3.) Color change 4.) Formation of a solid	mixed.	matter. • Investigations can help them understand a concept that is difficult to visualize otherwise. • Matter will be studied in many different ways throughout schooling—Properties of matter, mass, balancing chemical equations, protons/neutrons/electrons, etc. • What potential problems could occur when two substances are mixed together?

Experiences, Patterns & Explanations:

Experiences	E → P	Patterns	P → E	Explanations
Opportunities to collect observations or "data" about the world; may involve in-class activities as well as recollection of students' shared experiences	Opportunities to share and represent data and/or observations to support and scaffold pattern-recognition	Relationships and generalizations across experiences that clarify and represent "what happened"	Supporting students in making generalizations from specific phenomena to explaining "how and/or why the world works"	Grade-level appropriate statements which generalize beyond specific objects/experiences described in the patterns to answer questions about "how or why" phenomena occur in the natural world
Explore and Investigate: Students will participate in hands-on laboratory investigation stations. • The students will participate in a hands-on lab where they mix baking soda and vinegar in a plastic cup to produce a chemical reaction that results in fizzing/bubbling. • The students will observe the teacher make Elephant's Toothpaste, which will produce heat. The students will be able to come up to the	• Students will complete a chart in which there will be three boxes for each reaction. In one box, they will draw what each substance looked like at the beginning, before they were mixed. In the second box, they will draw what the substances	• We can mix different things together. • What did you notice about your before and after drawings? • The properties of the things (substances) we mix together change. • When we mix things together, they bubble. • When we mix things together, they change colors. • When we mix things together, they create	Looking at the patterns, what do we notice about the final product of each reaction? Can we still see the things we mixed together at the end? Do they still look the same?	When we mix things together, the things we mix look different at the end. They do not look the same as they did before we mixed them. We can mix two or more things together to create something new that has different properties.

teacher's station to feel the heat. • The students will watch a short video in which potassium iodide and lead nitrate are mixed to create a chemical reaction that shows a color change and forms a solid ("Golden Snow.")	looked like at the end, after they were mixed together. In the third box, they will write notes about what they observed and how the properties of the substances changed from beginning to end. • The students will discuss what they recorded with their small lab group members. • Each small group will have a reporter, who will share the	heat. • When we mix things together, they make solids (or precipitates).		

	group's observations with the whole class.			

Planning for Assessment

Task Name: Writing Prompt

Post Assessment Task:

After the wrap-up discussion, I will distribute the worksheet below. The students' task is to write a paragraph that includes a description of the properties of the substances before and after they are mixed together. They must also state whether or not the substances changed when they were mixed together, with an explanation of how they know. All of these answers will be based on a new chemical reaction the students have not seen before. The video "Copper Chloride + Water Meets Aluminum Foil" (http://www.youtube.com/watch?v=5xdZqCoLIAs) will be played, and the students will write their responses afterwards.

Name _____

After watching the video, write a paragraph that includes the following information:

- Describe the properties of the substances at the beginning.
- Describe the properties of the substances at the end.
- Did the substances change when they were mixed together? How do you know?

Post Assessment Task Rationale:

This task allows me to discover if my students can accurately identify what occurs during a chemical reaction. The students should be able to identify that when two substances are mixed together, they create a new substance, which has different properties. Through participating in a lab and watching videos of various chemical reactions, students will observe the various signs that a chemical reaction has occurred (color change, odor, fizzing/bubbling, creation of heat, etc.). The goal is for the students to be able to identify that a chemical reaction has occurred and to explain why using the information learned during the lesson.

This task assesses the students' understanding of the NGSS standard I selected: 5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in a new substance. The students are prompted to describe the properties of the substances before and after they are mixed together, and to provide rationale as to how they know whether or not the substances changed when mixed together, using the signs mentioned above. This also guides them in answering the Driving Question: How do substances change when mixed together?

By showing them an additional chemical reaction we did not view or discuss during the lesson, they will be able to apply and demonstrate their knowledge in a new scenario. By asking the students to write a paragraph, they will provide an elaborate response, rather than just regurgitating a one-word answer.

Task Response Features You Are Looking For:

	STRONG UNDERSTANDING	PARTIAL UNDERSTANDING	POOR UNDERSTANDING
Describe the properties of the substances at the beginning.	Accurately describes the properties of **BOTH** substances at the beginning, before they are mixed. - The copper chloride is a bright blue liquid. **AND** - The aluminum foil is shiny and silver.	Accurately describes the properties of **ONE** substance at the beginning, before the substances are mixed. - The copper chloride is a bright blue liquid. **OR** - The aluminum foil is shiny and silver.	Inaccurately describes **BOTH** substances before they are mixed **OR** Does not provide a response.
Describe the properties of the substances at the end.	Accurately describes the properties of **BOTH** substances at the end, after they are mixed. -The copper chloride is a dark blue/gray liquid. **AND** -The aluminum foil is brown and no longer shiny.	Accurately describes the properties of ONE substance at the end, after the substances are mixed. -The copper chloride is a dark blue/gray liquid. **OR** -The aluminum foil is brown and no longer shiny.	Inaccurately describes **BOTH** substances after they are mixed **OR** Does not provide a response.
Did the substances change when they were mixed together? How do you know?	The student recognizes that **YES**, the substances change when they are mixed. **AND** Identifies **BOTH** clues that show a new substance has been created—Color change & fizzing/bubbling.	The student recognizes that **YES**, the substances change when they are mixed. **AND** Identifies **ONE** clue that shows a new substance has been created—Color change **OR** fizzing/bubbling.	The student says **NO**, the substances do not change when they are mixed. **AND/OR** Does not accurately identify either clue that a new substance has been created. **OR** Does not provide a response.

If a student is 3/3 in a given understanding category, they automatically receive that score. For example, if a student scores Strong Understanding for all three prompts, their overall score is Strong Understanding.

If a student's scores are distributed across two or three understanding categories, the teacher may use his/her discretion based on the information the student provides to determine the overall score.

Instructional Procedures Chart

Activity & Time	What the Teacher Does and Says	Anticipated Student Responses	Academic, physical, social & linguistic needs	I-AIM Function and Rationale Select an I-AIM function below that matches the activity you've described. Explain how this activity matches that function. • Establish a question • Elicit student's initial ideas • Explore experiences and ideas for patterns • Students explain/apply patterns
Setting Behavior Expectations	The students will sit on the rug in the back of the classroom while I explain the expectations for the lesson. Today we are going to do some hands-on science! You will be working with your shoulder partners, so before we begin, let's take a minute to think about what working together looks like. First of all, every group member should contribute to the experiment. You should all have a wooden chip at your desk. Your chip is in the shape of a butterfly, flower, heart, or teddy bear. When you receive the lab instructions, you will notice that each step has shapes next to it. If you are the group member with that shape, you will be responsible for completing that step. When we work together as scientists, it is important to encourage one another. Be a supportive partner, and let your friend have their turn, as you will get	I anticipate that the students will ask questions about the expectations.	I will provide a poster that's titled "A Great Scientist…" and contains all of the expectations I outlined at the beginning of the lesson so students can refer back to it when they need a reminder about what they should be doing.	N/A

	your own turn, too. You can help your partner, but use your words, not your hands. Today we are working like true scientists. It is important we are not only respectful of our partners, but also of your teachers and your materials. It is extremely important you listen carefully. You will receive directions about how to use the materials in the lab kits I pass out to you. Good scientists do not touch their materials or begin their work until they listen to and read the directions. They do not put the lab materials in their mouth, nose, or anywhere they are not asked to. They also stay in their seats and raise their hand when they have a question. Lastly, great scientists clean up their lab stations when asked to, and wash their hands when they are finished in the lab. I know everyone in this classroom is a great scientist and will be a responsible self-manager during our lab. If you need a reminder about what is expected of you, please refer to the "A Great Scientist…" poster in front of the room. Does anyone have any questions about these expectations? –Pause and let students respond- Everyone please return to your seat. Very quietly, I need you to completely clear off your desk. All you need is a pencil and your wooden shape. I am going to count down from ten. When I am finished counting, I would like to see you and your shoulder partner sitting next to each other with nice, clean, desks.			

Introduction to the Lesson	I will pose the driving question to the class: "How do substances change when mixed together?" In other words, if we mix different things together, what happens to them? I will call on volunteers and write their ideas on a poster board.	I anticipate that the students will share their ideas about the driving question. Based on the data I gathered during my science talks, I think the students will claim that the substances will explode.	I will record the students' ideas on a poster, and will write using large, dark, print to allow the three students with visual impairments (who never wear their glasses in class and sometimes sit at the teacher's desk) to see the ideas clearly from their lab stations.	• Establish a question—The students are asked the driving question that provides a meaningful basis for the rest of the lesson. • Elicit students' initial ideas—The students are asked to share their ideas about the driving question. The teacher probes their responses to explore their understanding further.
Hands-On Lab Experiment: Vinegar and Baking Soda *20 minutes*	• I will pass out the lab packet, which contains the direction sheet (List of materials, sequential steps, and assigned partner roles) and the observation table. • I will give each pair a couple of sheets of newspaper to cover their workspace. • I will read the lab directions aloud as the students follow along. • I will distribute the lab materials to each group. Once they have their materials, they are free to begin working. • After the group finishes lab,	• I anticipate that the students will be very engaged in this activity. • I anticipate that the students will ask questions about the directions. • I anticipate that the students will "Oooh" and "Ahhh" when their reaction begins to bubble and bring this to my attention. • I think the students will observe the potent smell (of the vinegar) at the beginning of the lesson and recognize that the baking soda is a powder. At the end, I think they will observe that the baking soda no longer looks like a powder.	-Although the students have the lab directions in front of them, I will also read them aloud with the students. This will address the needs of my dyslexic students or those who struggle with reading fluency. -I will remind the students of the "A Great Scientist…" poster at the front of the room.	Explore Experiences and Ideas for Patterns—The students are conducting a hands-on experiment that shows them that when we mix two things together, they can produce fizzing/bubbling. They may also notice that at the end, the baking soda and vinegar do not look the same as they did in the beginning. They also make and record observations about their experiment.

	they will record their findings in the lab packet. In the first box, they will draw what the substances looked like at the beginning of the experiment. In the second box, they will draw what the substances look like after they mixed them together. In the third box, they will write notes about what they observed and how the properties of the substances changed from beginning to end.		-If I notice a group's dynamic is not working, I will approach the group and discuss how I can help them work as a team.	
Transition *5 minutes*	I will call each group up to dispose of their materials and wash their hands. When they are done, they should return to their seats and review their observation tables.	I anticipate that the students will become distracted and want to talk to one another about the experiment.	I will inform the students that we will have an opportunity to discuss what we saw in a few minutes. For now, I need them to direct their attention to the front of the room so I can show them something really cool.	N/A
Elephant's Toothpaste Demonstration *10 minutes*	• I will ask the students to keep their observation tables out. • I will perform the Elephant's Toothpaste experiment in front of the students. I will explain each step out loud as I perform them. I will explain that I am mixing hydrogen peroxide, dry yeast, water, dish soap, and food coloring. • I will also ask the students what	• I anticipate that the students will ask questions about the directions. • I anticipate that the students will "Oooh" and "Ahhh" when their reaction begins to foam. • I anticipate that the students will shout out comments and questions about what happened. • At the beginning, I think the students will	-If there are open seats in the front of the room, I will invite the students sitting in the back to move forward so they can see the reaction more clearly. -I will explain each step as I	Explore Experiences and Ideas for Patterns— The students are recording the observations they made in their observation table, and are working towards recognizing a pattern about what happens to substances when we mix them together.

	each substance looks like, since they won't get to see it as closely like in the vinegar/baking soda experiment. • Once the reaction is complete, I will invite the students up by rows to feel the heat that is radiating from the foam. I will ask them what it looks/feels like now. • The students will draw and record their observations on their observation table.	observe that some of the substances are liquids, one is a solid (yeast) that looks like sand, and they have seen some of these things before (water, dish soap, food coloring). At the end, I think the students will observe that the "Elephant's Toothpaste" is red because of the food coloring, and that the reaction causes foaming/bubbling. I think they will easily recognize that the substances do not look the same as they did when we started.	perform it for clarification and incase there are students who cannot see clearly.	
Transition *1 minute*	I will ask the students to put their pencils down and turn their attention to the screen.	I anticipate that students will ask if we are going to watch a movie or video.	-I will allow the students who moved forward to stay where they are seated so they can see the video well. -I will adjust the volume of the video accordingly so all students are able to hear it clearly.	N/A
Golden Snow Video *5 minutes*	• I will play part of the "Make Lead Iodide-And the Golden Snow" Youtube video and ask the students to watch closely. • I will pause the video before the substances are mixed and ask the students what the before substances look like. At the end of the video, I will ask	• I anticipate that the students will "Oooh" and "Ahhh" when the Golden Snow begins to form. • I predict the students will observe that in the beginning, the substances are colorless. A white powder is mixed with clear liquids. At the end, I think the students will observe that a color change has occurred and that solids have been	-See "Transition" row above.	Explore Experiences and Ideas for Patterns— The students are recording the observations they made in their observation table, and are continuing to work towards recognizing a pattern about what happens to substances when we mix them together.

	them what the substances look like after. • Per usual, students will observe the substances at the beginning and end of the experiment and record their observations on their observation tables.	formed.		
Lesson Wrap Up *10 minutes*	• I will revisit the poster with all of the students' original ideas. • I will ask the driving question once again: "How do substances change when mixed together?" • The students will review all of the columns/rows on their observation table. After the class discussion and analyzing their drawings and notes, they will individually answer the driving question on the bottom of the observation table: "How do substances change when mixed together?"	• I anticipate that the students will produce more accurate and complex answers than they did the first time. • At this point, I anticipate that the students will respond to the question with answers such as: Color change, foaming/bubbling, formation of heat, and formation of a solid. • I anticipate that the students will need reminders to work quietly and individually on the assessment task.	I will walk around the classroom and monitor the students as they work and will answer questions when needed. However, I will not spoon-feed them the answer to the question. I will ask the struggling students probing questions to help them produce a response.	Students Explain/Apply Patterns—The students use their knowledge to explain what happens to substances when they are mixed together. They should recognize that the substances mixed together create a new substance with new properties. They should refer to examples of properties they observed during the experiments such as color, heat, fizzing/bubbling, formatting of a solid, etc.
Assessment Task *12-15 minutes*	• I will distribute the lesson assessment worksheet and read the directions to the students before playing the video. This way, they know what they should be looking for. • I will then play the video "Copper Chloride + Water Meets Aluminum Foil" https://www.youtube.com/watch?v=5xdZqCoLIAs	• I anticipate that the students will be able to utilize the knowledge they gained throughout the lesson and during the wrap-up discussion to make the following observations: ○ At the beginning, the copper chloride is bright blue, and the aluminum foil is shiny and silver. ○ At the end, the copper chloride is a dark blue/gray color, and the aluminum foil is brown and no longer shiny. ○ The students will be able to identify	-I will allow the students who moved forward to stay where they are seated so they can see the video well. -I will adjust the volume of the video accordingly so all students are able to hear	Students Explain/Apply Patterns—The students use their knowledge to explain what happens to substances when they are mixed together. In this case, they will be doing this independently with a reaction they have never seen before. They should recognize that the substances mixed together create a new substance with

	• When the video is finished, the students will complete the writing prompt.	that the substances have changed and explain that they know this because they saw bubbling and a color change occur.	it clearly. -If needed, I will play the video a second time for students who need more time to observe the reaction.	new properties. They should refer to examples of properties they observed during the experiments such as color, heat, fizzing/bubbling, formatting of a solid, etc. when appropriate.