Fifth Grade Instructional Segment on Physical and Chemical Changes

Students will gain an understanding of the difference between how things change physically or chemically.

Student Science Performance

Grade Level - 5th	**Title:**
Topic - Chemical and Physical Changes	Balloon Blow up!

Performance Expectations for GSE:

S5P1 - Obtain, evaluate, and communicate information to explain the differences between a physical change and a chemical change.

a. Plan and carry out investigations of physical changes by manipulating, separating and mixing dry and liquid materials.
b. Construct an argument based on observations to support a claim that the physical changes in the state of water are due to temperature changes, which cause small particles that cannot be seen to move differently.
c. Plan and carry out an investigation to determine if a chemical change occurred based on observable evidence (color change, gas, temperature change, odor, new substance produced).

Performance Expectations for Instruction:

Students will

- Investigate physical changes.
- Make claims based on evidence that water is changed from solid to liquid to gas and gas to liquid to solid based on temperature changes.
- Develop a model to describe that matter is made of particles too small to be seen.
- Measure quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
- Make observations to identify materials based on their properties.
- Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
- Collect and analyze measurement data such as temperature, liquid amounts, and weight,

Additional notes on student supports

Materials for Physical Changes Introduction:

- Hot plate or hot pot for teacher demonstration
- Immersion thermometer
- Cooking pan
- Water
- Clear cups
- Cling wrap
- Ice
- Tongs
- Flask with small mouth or glass soda bottle
- Balloon

Materials for Physical Changes Lessons:

- Clear cups
- Water
- Sugar or salt
- Spoon
- Sand, soil, gravel, etc.
- Small objects to stir into water such as paper clips, coins, counters, etc.
- Magnet for separating paper clips from water or sand
- Paper
- scissors

Materials for Chemical Change Lessons:

- Plastic water bottles: Recycle used small plastic water bottles or use filtering flasks or soda bottles (Minimum-- one per group. The quantity depends on how many students are conducting the experiments. Wash out bottles to use for each investigation if quantity is limited.)

Demonstration for phenomenon:

- 4 oz. Vinegar
- Red food coloring
- 1 Tablespoon of dish detergent
- 2 Tablespoons of Baking soda
- Thermometer

Investigation for small groups

- Vinegar
- Food coloring
- Dish detergent
- Baking soda
- Clear cups
- Measuring tools-- graduated cylinders or measuring cups, measuring spoons, balance or scale

Experiment 1 for small groups

- Balloons (1 per group) *(Stretching the balloons before putting them on the top of the bottle will increase success.)*
- Materials from the investigation for small groups

Experiment 2 for small groups

- Balloons
- Yeast (1 Package per group)
- Warm water
- 1 tsp. sugar
- Balance or Scale
- Balloon Blow UP Instructions (You can project them or give each group a copy.)
- Balloon Blow UP Recoding Sheet (One per student)

Engaging	**Phenomenon for Physical Changes of Water** Heating and cooling water in a flask with a balloon covering the mouth of the bottle Put water in a flask and cover the top of the flask with a balloon. Set the flask on the hot plate or in a hot pot of water and heat until water expands and begins to inflate the balloon. Use tongs to take the flask off the heat and put it in a bowl of ice to show the balloon deflates. On the top of a sheet of paper have students sketch and write their claims about what is happening to the water in the flask to cause the balloon to change size and shape (inflate and deflate). *Obtaining* Instruct them to draw a line under their explanation to show the line of learning. Have them gather information about the phenomenon they observed and revise their claim based on the evidence they have obtained. Lead students to discover that particles move differently when hot (spread out and move more quickly) and when cold (closer together). *Evaluating* They will now draw and write and explanation under the line of learning to show their revised claim based on their evidence and reason how their learning has changed. *Communicating* Have them discuss what they have learned about the changes in water due to temperature changes. Use this as a demonstration to show students evidence of a how temperature change of the water in the bottle changes the size of the balloon. Explain that even though students cannot see the small particles of water as they spread out, there is evidence to show this happens. *Obtaining* Have students plan and carry out an investigation to develop ways to melt an ice cube more quickly, more slowly, etc. to show that temperature change impacts water and can cause a change in the state of matter—solid to liquid. Have students seal the top of a clear cup of warm water with cling wrap. Have them put an ice cube on top of the wrap. Instruct students to watch what happens in the cup to see the liquid water invisibly form water droplets on the underside of the cling wrap. *(The warm water vaporizes and this gaseous state rises. When it reaches the top of the cup, it cools and condenses back into its liquid state.) Remind students that this is the water cycle that they studied in fourth grade and now they are learning about the invisible particles that cause this to happen. Have them use words such as vapor, condense and precipitate.*

	Ask students if they have noticed water forming on the outside of a glass with ice in it.
	Evaluating Have them produce drawings explaining how water can change from solid to liquid to gas and back again due to temperature changes. *Communicating* Have students explain why this is a physical change. (The water does not become a new substance even though it is heated or heat is removed to become a solid, liquid or gas. It is still water.) *Begin using correct explanations that cool and cold are words that describe removing heat from an object.* ***Phenomenon:*** Elephant Toothpaste This is a video that shows a solid and a liquid creating a gas in the experiment for elephant toothpaste which is a chemical reaction. (other videos are available online, some more dramatic) OR Why a Candle Burns Did you know that it is the gas from the melting wax that burns and not the wick? Bewilder your students with this phenomenon too! *Obtaining* Students will obtain information about chemical changes by observing the Elephant Toothpaste videos, watching the explanation of candle burning, or observing a teacher demonstration. Remind students about volcanoes they studied in the Earth's Processes Instructional Segment and simulate lava flow for them. Use a tray under this since it could get messy. Mix vinegar, dish detergent, and red food coloring in a cup. Remind them about what we know about mixtures of liquids and that it is a physical change. Then put baking soda in a clear shallow bowl or small water bottle. Pour the vinegar solution over the baking soda to see it foam. Use a thermometer before, during and after to show a temperature change. Do the same process only use water in the place of vinegar. There is no reaction, so it is a physical change.

	Communicating Ask students to explain how this change is different from a physical change. Explain that a chemical change produces a new substance and can change temperature, give off a gas, or produce a new odor. *Evaluating* In their student journals, students will explain their thinking by responding to the following questions: ● What materials were used in these experiments? ● What was the same and what was different? ● What procedures were followed in these experiments? Try to write the procedures so that someone who has not done the experiment can try it too! ● What were the results of the experiments? Make sure to explain what type of change took place (physical or chemical) and how you know. ***Evaluating*** In their Science Journals, students will explain the experiment, and in the results, will restate how they know a chemical reaction occurred. (Expect a sentence about the gas produced and the fact that the bottle changed temperature which is another sign a chemical reaction occurred.) *A major practice of science is the communication of ideas and the results of inquiry—orally, in writing, with the use of tables, diagrams, graphs, and equations, and by engaging in extended discussions with scientific peers.* ***Communicating*** When students are finished with their journal entry, have a class discussion to restate what happened in the experiment and how they know a chemical reaction occurred. Ask the students questions to get them thinking: ● What if we had used less baking soda or less vinegar? Or more baking soda or more vinegar? ● Why is measuring in science an important skill? Instruct students to plan an investigation using the same materials but in different amounts. Have them devise a chart for collecting measurement data and results. When the investigation plan and charts are approved by the teacher, allow students time and materials to carry out their plan. Have them write what they found out and how they would change their process the next time.

Exploring	*Obtaining* Ask students if they can think of other times that materials are changed, but remain the same material. Begin with a discussion of substances we can mix in water such as putting objects such as paper clip, coins, counters, etc. in the water and retrieving them to show that they can be added and separated. When students are comfortably explaining the process of adding and separating objects in liquids, introduce dissolving sugar. Have students dissolve a teaspoon of sugar in a small glass of warm water and pour it out onto a plate uncovered. After a few days, the water will evaporate and leave the sugar crystals. Explain that the two materials stayed water and sugar. They did not become a new substance. Have students explore other substances such as sand, potting soil, gravel, etc. Have students devise ways to separate the mixtures using evaporation, filtration (pouring through a coffee filter), recovering paper clips using a magnet, etc. Have students discuss foods they eat that are mixed instead of changed by cooking such as tacos, salads, nachos, sandwiches, etc. *Communicating* Have them plan and carry out an investigation showing others how to physically change materials. They could fold paper into origami shapes, cut paper into different patterns (snowflakes, silhouettes, etc., make food mixtures (salad, Kool aid, trail mix), use a magnet to separate paper clips in sand, etc. *Teacher Notes: Remember that this is student directed. The students will plan their investigation and write up a plan including materials, step by step instructions, and data they will collect and analyze.* Have students share their investigations with others in the class making the claim that their investigation is demonstrating a physical change and giving evidence why this is so. Invite the class to ask questions about the claim and evidence given. If more than one group or individual chooses the same investigation, have them compare their claims and evidence. *Evaluating* Ask students to explain how materials and objects are physically changed but remain the same material. Ask students what would happen if a material was changed chemically? ***Phenomenon:*** Students will inflate a balloon using the gas produced by combining baking soda and vinegar.

	Set the students up in groups (3 to 5 students per group). Assign each student a specific task. This can help your labs run more smoothly and helps with classroom management. Leader - Makes sure everyone is on task Speaker - The only student who can talk to the teacher for the group Recorder - Does all the writing and recording for the group Timekeeper - Makes sure the group's time is managed wisely Materials Manager - The only student who can gather the supplies Student Handout Part 1: Balloon Blow Up Materials per group: • one bottle • one balloon (Have extras in case someone tears the top trying to get it on the bottle.) • 4oz. vinegar • 2 Tablespoons of baking soda to each group • access to a balance or scale Students use the scale or balance available for students to weigh the separate parts of the experiment, get the total weight, and then weigh the bottle with the balloon again at the end to see if the weight changed. *Teacher Notes: If students put the baking soda in the balloon and not let it spill into the bottle before placing it on the bottle with the vinegar, it will save a bit of hassle trying to quickly put the balloon on the bottle while the reaction is taking place. The balloon will not completely inflate but will trap the gas inside and expand.* Students will conduct their experiment and observe the results. **Procedures:** • Assign roles for members of their group. • Students will gather all materials. • Students will add baking soda to the bottles, or you can provide the bottles with the baking soda already in them. • Students will weigh their bottles with baking soda and record the weight. • Weigh the balloons. • They will then weigh the cups with vinegar. Instruct them to also weigh an empty cup so they can find the weight of the vinegar separately by subtracting the weight of the cup from the total weight of the cup and the vinegar. • Students will add the vinegar and will ***quickly*** put the balloon on top of the bottle. Have them practice putting the balloon on the bottle before they add the vinegar. • Students will then observe the changes. If groups do not notice on their own that the bottle changed temperature, instruct them to touch the bottle.

	Obtaining Students will discuss the results of the experiment first with their groups. ● What caused the balloon to blow up? ● What kind of change was this? ● How do you know it was a physical change and/or a chemical change? (*Teacher Notes: Chemical change evidence is that a gas was released, and the temperature changed.*) Bring the students together for a class discussion. After the discussion, challenge them to draw a storyboard of what they think happened in each step. *A storyboard has panels like a comic strip.* ***Evaluating*** Students will discuss how they know a chemical reaction occurred. Students will describe the experiment and will explain the process, how they know a chemical change occurred with exact details that show they know what signs they should recognize as a chemical change on their lab sheet. ***Communicating*** Students will share their responses and explanations with the class

Explaining	***Evaluating*** Encourage students to elaborate on their ideas and thoughts. Questions to initiate class discussion: What is the solid in the experiments? What is the liquid? How do the solid and liquid create a gas? Give specific examples of how you know when a chemical reaction took place. ***Communicating*** Refer to the Elephant Toothpaste experiment and the balloon experiments. ● How are they alike, and how are they different? ● What happened when water was added to the baking soda instead of vinegar? ● What other liquids do you think would have gotten the same result as the vinegar? ● As the water? Have students respond in their journal to the questions.
Assessment of Student Learning	
Elaborating	**Student Science Performance** Challenge students to plan and carry out an investigation that will increase the success of the balloon on the bottle experiment. Have them list their specific materials and their step by step method for carrying out their investigation. *Teacher Notes: Students can substitute different materials, change quantities, manipulate the balloon, change the size of the bottle, etc. This is a student-directed part of the lesson.* Once you have approved their plan, give them time to collect data and analyze their results. In whole group ask them what they changed, what they kept the same, and what they would do next. ***Phenomenon:*** Students will perform a second experiment to inflate a balloon using yeast and warm water. Students measure before, during and after. ***Obtaining*** Students will describe the results of the experiment first with their groups. Why did the balloon inflate? What kind of change was this? How do you know it was a chemical change? *Teacher Notes: This is a chemical change. When the yeast feeds on the sugar, it produces carbon dioxide. The carbon dioxide inflates the balloon. This is the same process that causes bread to rise.* Student Handout: Balloon Blow Up Part 2

	Procedures:
	• Gather all materials.
	  ○ plastic water bottle
	  ○ package of yeast (Yeast needs energy (food) to live.)
	Teacher Notes: Yeast is a microorganism. Have students note the beneficial and possible harmful effects of this organism.
	  ○ warm water
	  ○ 1 tsp. sugar
	  ○ balloon
	  ○ recording sheet
	• Weigh the empty bottle. Record the weight on the recording sheet.
	• Weigh the balloon, record the weight and set it aside.
	• Pour 2 inches of warm water in a plastic bottle and add the teaspoon of sugar. Swirl to dissolve the sugar in the water.
	• Weigh the bottle with the sugar water. Subtract the weight of the bottle from the new weight to find the weight of the sugar water. Record the weight.
	• Put the yeast in the bottle of warm sugar water.
	• Stretch the balloon slightly. Put it on the top of the bottle.
	• Weigh the bottle with the yeast, balloon and sugar water and find out how much the yeast weighed by subtracting the weight from step #5 from the total.
	• Observe.
	
	Evaluate Students will discuss how they know a chemical reaction occurred. How was this experiment and reaction different from and similar to the vinegar and baking soda investigation? Discuss states of matter. What was the solid? What was the liquid? Did this investigation generate a gas? Give a change in odor?
	
	Communicating In their Science Journals, students will describe the experiment and will explain the process, how they know a chemical change occurred detailing how to recognize a chemical change. Students will share their journal entries with the class.

Evaluating Learners	***Evaluate and Communicate:*** Students will be assessed on their lab recording sheet and their explanation of both experiments, how they recognize a chemical reaction, and the comparison and contrasting of both experiments. The Milestones End of Grade Study Guide Resources give teachers an idea of the level of questioning expected: Georgia Milestones End of Grade Study/Resource Guides for fifth grade.

SEP, CCC, DCI	**Science Essentials**
Science Practices	• Planning and carrying out investigations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information
Crosscutting Concepts	• Cause and Effect • Stability and change • Matter and energy
Disciplinary Core Ideas	From A Framework for K-12 Science Education: • PS1.A: Structure and Properties of Matter • PS1.B: Chemical Reactions

Additional Supports for struggling learners:

The following supports are suggestions for this lesson and are not the only options to support students in the classroom. These supports target students that struggle with science material, this lesson or a previous lesson. These are generalized supports and do not take the place of IEP accommodations as required by each student's Individualized Education Program.

General supports for the following categories:

Reading:	Writing:	Math:
1. Provide reading support by reading aloud or doing partner reads 2. Have the teacher model what they are thinking when reading the text 3. Annotate the text with students so that they may refer to it as they work through the lab	1. The teacher can provide a sentence starter for the students. 2. The teacher can give students an audience to write to (i.e. Write a letter to your sibling explaining this topic). 3. The teacher can provide constructive feedback during the writing process to help students understand the expectations.	1. Provide calculators as needed. 2. Remind students of the units of measurement.

Supports for this specific lesson if needed:

Performance expectations for instruction:

1. The teacher should provide information to students in various formats to reach as many students as possible.
2. The students should be given adequate time to complete each part of the lesson.
3. The students should be allowed to express their knowledge in various formats.
4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material.

Engaging:

1. The teacher should provide the students an organizer to record their observations, drawings, claims and reasoning.
2. The teacher should provide students resources that they could use to find information on the phenomena.
3. Students may need additional time to revise their claim and provide evidence for the change.

4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include drawing, writing or acting it out.
5. The teacher should make sure that there are guidelines in place prior to conducting a class discussion. This should make students feel more comfortable voicing their thoughts in class.
6. The teacher should provide an organizer to plan their investigation, record their observations and explain what is occurring as the ice melts.
7. The teacher should have students record observations of the melting ice at specific times and draw the water inside the cup at various intervals (Example: record and draw what you see every 2 minutes).
8. Ask students what the difference in their observations from the balloon filling with hot air and the elephant toothpaste or candle.
9. The teacher should be sure to provide some specific instructions for students in designing a chart for collecting evidence.

Exploring:

1. The teacher should provide an organizer and have students record observations during the demo for both the physical and chemical change.
2. Prior to the students trying to design their own procedure, the students, will most likely benefit from a demo on how to write a procedure. An easy demo of this is to have students guide the teacher to make a peanut butter and jelly sandwich (do not do peanut butter if there is a student with a peanut allergy in class). Do not do anything that the students do not instruct the teacher to do. So, this may result in the teacher trying to get Jelly out with the lid still on the jar or any number of other strange things.
3. The teacher should provide an organizer for the students to plan their investigation, record data and draw conclusions.
4. The teacher should give students different ways to share their investigations. This will help students that have anxiety about presenting a different avenue to communicate their work. This could be done using sticky notes, a silent walk around the classroom or using technology to summarize the investigation.
5. The teacher should provide the students a lab sheet to record their thoughts, data and conclusions about the chemical change lab.
6. The teacher should remind students how to use the balance and the units of measurement that the balance is using.
7. The teacher can make the set-up process easier by modeling how to fill the balloon with baking soda and fitting it over an empty bottle.
8. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include drawing, writing or acting it out.

Explaining:

1. The teacher should provide discussion questions to students in advance. This will allow struggling students to formulate responses in advance and ease some of the anxiety about participating in class discussions.

2. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include drawing, writing or acting it out.
Elaborating: 1. The teacher should provide an organizer to students to help with setting up their investigation. 2. Students may need additional time to plan and carry out their investigations. 3. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include drawing, writing or acting it out.
Evaluating: 1. Students may need additional time to complete their explanation.

Directions - Balloon Blow Up with Vinegar

1. Materials person gather all materials.
    - plastic water bottle
    - 4 oz. vinegar
    - 2 Tablespoons baking soda
    - balloon
    - recording sheet

2. Weigh the bottle. Record weight on the recording sheet.

3. Put the baking soda in the bottle.

4. Weigh the bottle with baking soda. Subtract the weight of the bottle to find the weight of the baking soda and record the weight.

5. Weigh the balloon and record the weight.

6. Weigh the cups with vinegar. To find the weight of the vinegar, weigh an empty cup. Subtract the weight of the cup from the total weight of the cup and the vinegar. Record the weight of the vinegar.

7. Stretch the balloon slightly.

8. Add the vinegar and ***quickly*** put the balloon on top of the bottle.

9. Observe.

10. Then weigh the final product.

Directions - Balloon Blow Up with Yeast

1. Gather all materials.
    - plastic water bottle
    - package of yeast
    - warm water
    - 1 teaspoon of sugar
    - balloon
    - recording sheet

2. Weigh the bottle. Record the weight on the recording sheet.

3. Add two inches of warm water to the bottle.

4. Weigh the bottle with the water. Subtract the weight of the bottle from the new weight to find the weight of the water. Record the weight.

5. Put the yeast in the bottle.

4. Weigh the bottle with the yeast. To find the weight of the yeast, weigh the bottle again and subtract the total weight now from the weight of the bottle with water from the last step. Record the weight of the yeast.

5. Weigh the balloon and record the weight.

6. Add two inches of warm water to the bottle.

7. Weigh the bottle with the yeast and the water. To find the weight of the water, subtract the total weight now from the weight of the bottle and yeast. Record the weight of the water.

7. Stretch the balloons slightly. Make sure you are ready to put the balloon on the opening of the bottle.

8. Add the sugar and swirl the bottle a little and ***quickly*** put the balloon on top of the bottle.

9. Observe.

10. Weigh the final product.

Return to Instructional Segment

Balloon Blow Up! (Part 1)

NAME _____ DATE_____

Use a balance or scale to measure before and after the experiment.

RECORD YOUR DATA:

Vinegar and Baking Soda

Object	**Weight**
Bottle	
Baking Soda	
Balloon	
Vinegar	
Sum of the objects *(total from above objects)*	
Sum of the objects (*after the experiment is complete*)	

Describe the experiment and explain how you know when a physical change or a chemical reaction occurred.

_____

_____

_____

_____

_____

Did the weight of the bottle and its ingredients change from beginning to end?

_____

How would you change this experiment to get different results? Plan this to include materials needed, step by step instructions, data you will collect, and what this data will tell you.

Materials:

Plan:

Data:

Evidence based on data:

Return to Instructional Segment

Balloon Blow Up! (Part 2)

NAME _____ **DATE** _____

Use a balance or scale to measure before and after the experiment.

RECORD YOUR DATA:

Yeast and Warm Water

Object	**Weight**
Bottle	
Warm Sugar Water	
Yeast	
Balloon	
Sum of the objects *(total from above objects)*	
Sum of the objects (after the experiment is complete)	

Describe the experiment and explain how you know when a physical change or a chemical change occurred.

_____

_____

_____

_____

_____

Did the weight of the bottle and its ingredients change from the beginning to the end?

_____

How is this investigation similar from the one using baking soda and vinegar?
How is it different?
What would you like to investigate next?

Return to Instructional Segment