

NVACSS Lesson Plan Template

Grade Level: 5th

Topic: Matter-Physical & Chemical Changes

General Lesson Description: (Include Estimated Time to Complete the Lesson)

The students will complete a series of different investigations in which will assist them in understanding the differences between a physical change and a chemical change in matter. Students will work with a variety of different materials to conduct a series of experiments . They will work to develop their knowledge of matter through notebooking, discussion sessions, modeling and the experimentation. This lesson will also help them to enhance the basis of evidence based learning through experimentation and sense making discussions.

This lesson consists of five different investigative lessons which will require time for experiment, writing and discussion pieces. There is also an optional lesson included for use as a demonstration for the whole class as well as a misconception discussion group piece. The lessons can be split if needed by conducting the experiment with notes in one half and the discussion and sense making taking place during the second half. This lesson is designed to fit your allotted time frame for teaching.

Estimated time for lesson completion:

Performance Expectation:

5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Clarification Statement:

None

Assessment Boundary:

None

Big Question:

What are changes in matter and what causes them?

Specific Learning Targeted Outcomes:

1. Students will be able to engage in scientific discourse about the differences between a physical change and a chemical change in matter.
2. Students will be able to provide evidence for use in further experiments and in discussion groups.
3. Students will be able to recall prior knowledge of the properties of matter to help expand their knowledge in understanding why and how matter can change.
4. Students will be able to engage in discussion groups to make sense of what they are witnessing as well as beginning to see both similarities and differences in the changes of matter.
5. Use scientific vocabulary when writing and sharing information.



NGSS Anchor Phenomena: https://www.ngssphenomena.com/search?q=matter What observations serve as evidence that a chemical reaction has occurred? (FOSS Phenomena)	
Background Information	
Prior Student knowledge to teach this lesson: This lesson is designed as an extension of FOSS, and is to be implemented after completing Investigations 1-5 in the Physical Science Mixtures and Solutions kit. This lesson can be completed if some of the investigations have not been taught, however, Investigations 1, 3 and 5 will have had to have been completed in order for the students to make complete sense of the lesson. This lesson will serve best to be implemented after Investigation 5 Part 3 as an overall cumulation of the FOSS kit. If you are not using FOSS, students will need to understand that matter is anything that takes up space and that matter is composed of atoms and molecules. They will need to understand that matter is always changing form either through a physical or chemical change. Mass is the amount of matter in an object and that the amount of energy in an object determines the phase of matter.	
Teacher background information around big ideas: Information provided is from the Background for Teacher found in Investigation 5-Fizz Quiz in the Mixtures and Solutions Kit from FOSS. We know what might happen when we mix one substance or material with water. We might observe that the substance gets wet, but nothing else. The substance might distribute throughout the water as a suspension. Or we might watch the substance disappear as it dissolves to form a solution. We know we can separate the mixtures to retrieve the starting substance by screening, filtering, or evaporating the liquid. The components of these mixtures interact physically, but can be pulled out of the interaction unaltered-none the worse for the experience. Some mixtures, however, behave in a fundamentally different manner. Some substances are predisposed to disintegrate into their constituent bits (atoms and ions) and reconstitute themselves in new ways. When this occurs, the starting substances cease to exist, and new substances are formed. The process that produces this transformation is a chemical reaction. Following a chemical reaction, the "mixture" cannot be separated into its starting substances by screening, filtering, or evaporation. The starting substances have been altered; new substances occupy their places. Calcium chloride and baking soda as two substances. Both are water soluble, forming clear solutions, and both can be rescued from solution by evaporation. When the two solutions are mixed, however, a reaction occurs. There is immediate evidence that things are changing. The mixture begins to bubble and fizz. It gets cold, and then it gets warm. It turns milky white. If the reaction cup is placed on a balance, you will observe that the mass of the system goes down. When the bubbling stops, there is a white substance in the cup, which is neither baking soda nor calcium chloride. What happened? Two starting substances, called reactants, changed into four new substances called products. Here's how that happened. (refer to pages 304 & 305 in Investigations Guide for models) **Continuation after explanation of the new products- Only two of the new products can be detected. Chalk precipitates (falls out) as a white insoluble solid that settles to the bottom of the cup. The carbon dioxide forms as an invisible gas, rises to the surface as bubbles, and vanishes into the air. (The mass of the escaping carbon dioxide accounts for the loss of mass	



of the system as the reaction goes forward.) The salt is soluble in water, so it is invisible in the reaction cup. The particle of water that forms is incorporated invisibly into the mass of water used to make the solutions in the first place. There is actually slightly more water at the end of the reaction than there was in the beginning.

Students make two additional mixtures of two substances that make solutions: calcium chloride/citric acid and citric acid/baking soda. The mixture of calcium chloride, citric acid, and water results in a clear liquid with no evidence of reaction. It forms a solution in which two substances are dissolved. This is a new idea for students. The citric acid and baking soda does produce vigorous bubbling, indicating a reaction, but no precipitate forms. The products are carbon dioxide gas and sodium citrate-a new, soluble substance.

Possible Student Misconceptions:

1. Students may think that a chemical change of matter is occurring when substances start to produce bubbles and/or any type of movement or change.
2. Any change in the appearance of matter is a chemical change.
3. The only physical changes of matter are the forms (solid, liquid, and gas).
4. That mass changes when elements of matter does.

Evidence Statements: How do students show mastery?

- Students will be able to describe the phenomenon under investigation, which includes the mixing of two or more substances.
- Students identify the purpose of the investigation, which includes providing evidence for whether new substances are formed by mixing two or more substances, based on the properties of the resulting substance.
- Students describe the evidence from the data that will be collected, including quantitative (e.g. weight) and qualitative properties (e.g., state of matter, color, texture, odor) of the substances to be mixed. Quantitative and qualitative properties of the resulting substances.
- Students describe how the collected data can serve as evidence for whether the mixing of the two or more tested substances results in one or more new substances.
- Students describe how the data will be collected, including: how quantitative and qualitative properties of the two or more substances to be mixed will be determined and measured. How quantitative and qualitative properties of the substances that resulted from the mixture of the two or more substances will be determined and measured. Numbers of trials for the investigation. How variables will be controlled to ensure a fair test (e.g., the temperature at which the substances are mixed, the number of substances mixed together in each trial).
- According to the investigation plan, students collaboratively collect and record data, including data about the substances before and after mixing.

<u>Science and Engineering Practices</u>	<u>Disciplinary Core Ideas</u>	<u>Crosscutting Concepts</u>
<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> • Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair test in which variables are controlled and the number of trials considered. 	<p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none"> • When two or more different substances are mixed, a new substance with different properties may be formed. 	<p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified and used to explain change.



Lesson Plan: 5E Model

ENGAGE:

1st Session

To begin the lesson, the teacher will need to ask the students to recall how ice is made. After a quick resounding response of 'by freezing water', pose the following question to them: Can ice be made another way? After the initial question please choose either the hands on or video demonstration to share with them. If you choose to do the hands on demonstration, the video may also be shared as it shows another way to create the ice as well as the science behind it.

Option 1: Teacher will begin the lesson with a "hot ice" demonstration. The teacher will activate an EZ Heat reusable instant handwarmer explaining the the class what it is and what its purpose is. The teacher will then cut open the handwarmer taking out what is inside and showing the contents to the class. The teacher will then take out another handwarmer and this time, instead of activating the handwarmer, the teacher will carefully cut the handwarmer open keeping it in view where the students can see that it is a liquid. The teacher will then pour the contents of the liquide onto a plate, thus creating "hot ice".

Option 2: Teacher will share with the class a video about "hot ice"

https://www.youtube.com/watch?v=AedL_NCv1Pw&feature=youtu.be

Assessment

Formative: Discussion about possible ways that ice can be made.

Summative: N/A

Engage Materials Needed and Website/Other Resources:

2 EZ Heat Reusable Instant Handwarmers

https://www.youtube.com/watch?v=AedL_NCv1Pw&feature=youtu.be

EXPLORE:

*Session numbers may vary. Depending on how much time you have to teach science, these lessons can be done separately, combined or all at once.

Teacher will explain that the students will be working in small groups to conduct investigations involving matter. What they observed in the opening lesson was a physical change in matter. Many students may have seen the experiment as a chemical change, in which will need to be addressed. Understanding that changing the state of matter of an object does not alter its mass, nor does altering its appearance. For mass to change, it must be altered in some way. This could involve removing some of the mass or adding material to the mass.

- **Investigation 1:** Each group of students will be given a bag containing two ice cubes to start with. They will need to determine the mass of the two ice cubes (and bag), record and set their bag aside (the ice will take some time to melt and the will need to record results at the end of the day). They will then, need to make a prediction as to what they feel the mass will be when the ice changes form from a solid to a liquid. (The mass shouldn't change as changing the state of water does not change its mass. Mass is conserved. This is an example of a physical change)
- **Investigation 2:** Each group of students will need to take and determine the mass of a sheet of construction paper, record and make a prediction as to what they think the mass will be after the paper has been torn into pieces. They will then need to tear the construction paper into pieces and find the mass and record the results. They will then need to get a sheet of plain white paper and follow the same steps as for the construction paper. They will then need to find the mass and record the results. (The mass does not change, it is conserved. Changing the appearance does not change the mass. This is an example of a physical change)

- **Investigation 3:** Each group will get a one cup filled with 20 mL of water and one cup that contains 5 mL of salt. They will need to find the mass of the two cups placed together on the balance. They will then make a prediction as to whether or not the mass will change once they mix the salt into the water. After creating the solution they will now find the mass the cup with the solution with the empty salt cup and record the results. (The mass should not change as mass was conserved)**Some students may argue that the mass did change as the result of a solution, however, all original elements were used in configuring mass. Even though a solution was created, this is an example of a physical change.
- **Investigation 4:** Each group will need to place 20 mL of water into a ziploc baggie and seal it. They will need to find the mass of the baggie of water with an Alka-Seltzer tablet and record. They will then need to open the baggie carefully, as to not spill out any of the water, drop the tablet into the water and quickly seal the baggie. They will then need to make a prediction as to whether or not they will have a change in mass. Once the tablet has dissolved, the students will then need to find the mass of the baggie and its contents and record the results. (The mass does not change, however, a new substance was created, which is carbon dioxide gas. This is an example of a chemical change)

Assessment

Formative: Discussions and Investigation Data Sheet 1: Matter and Mass

Summative: N/A

Explore Materials Needed and Website/Other Resources:

Balance for each group (can be found in the FOSS kit)

Water

Salt (can be found in the FOSS kit)

Alka-Seltzer Tablets (1 per group)

Construction Paper (1 sheet per group)

Copy Paper (1 sheet per group)

Ice Cubes (2 cubes per group)

Ziploc Baggies (will need 2 per group)

Popsicle or other material used for stirring (popsicle sticks can be found in the FOSS kit)

Plastic cups (small cups can be found in the FOSS kit)

Investigation Data Sheet

Science Notebooks

EXPLAIN:

Students will review their evidence from the investigations, discussing results and the evidence behind them. Students will also review and provide evidence for their choices on whether a physical or chemical change of matter occurred during each investigation.

After the students have a few minutes to review their notes, have them move into a sense making circle. To begin the discussion, ask the students to share what they discovered about the mass of the objects that they were working with. This should lead to a discussion about results, findings and 'a-ha' moments. If the discussion stalls, pause then prompt with questions that would further continue the discussion. You are wanting them to share results and things that they noticed which will lead them up to the understanding that mass is conserved. Throughout the discussion, the information of physical and chemical changes should also be brought up. You can lead them if it does not come up by asking them if matter changing affected the mass. You will then want to have them turn and talk to the person next to them and have them use their data to support their claim about mass during a physical or chemical change.

After the sense making circle, have students view the following video on mass and changes of matter:

<https://www.youtube.com/watch?v=x49BtB5dOwg>

Explain Materials Needed and Website/Other Resources:

Sentence strips for sense making circle

Science notebooks

<https://www.youtube.com/watch?v=x49BtB5dOwg>

ELABORATE:

Review and connect past lessons to today. Today the students will further expand upon the previous experiments conducted during the Explore portion of the lesson. The students will have the opportunity to revisit the previous investigations with some new alterations. The alterations to the investigations will lead students to alternate explanations as they apply/introduce new elements. This will result in them recreating some of the original investigations.

- **Investigation 1:** Each group of students will be given a dish and two ice cubes to start with. They will need to determine the mass of the two ice cubes (and dish), record and set their dish aside (the ice will take some time to melt and they will need to record results at the end of the day). They will then need to make a prediction as to what they feel the mass will be when the ice changes form from a solid to a liquid. (The mass will experience a change, as this time around the students are melting the ice cubes in an open dish in which we now have the process of evaporation which is changing the matter from a solid to both a liquid and a gas. Mass is not-conserved. This is an example of a physical change)
- **Investigation 2:** Each group of students will need to take and determine the mass of a sheet of construction paper, record and make a prediction as to what they think the mass will be after the paper has been written/drawn on and then torn into pieces. They will then need to draw/write on the paper and then tear the construction paper into pieces and find the mass and record the results. They will then need to get a sheet of plain white paper and follow the same steps as for the construction paper. They will then need to find the mass and record the results. (The mass may or may not change depending on the amount of drawing/writing done on the paper. Changing the appearance does not change the mass, however by writing/drawing on the paper and additional element is being added that would increase the mass. This is an example of a physical change)
- **Investigation 3:** Each group will need to place 20 mL of vinegar into a cup. They will need to find the mass of the cup with vinegar and record it. They will then need to add 5 mL of baking soda to the cup. They will then need to make a prediction as to whether or not they will have a change in mass and or chemical change**. ** (The prediction will want to be made prior to the students adding the baking soda to the vinegar as the reaction is instant). Once the mixture has settled, the students will want to determine the mass of the mixture. (The mass does change and a new substance was created, which is carbon dioxide gas. This is an example of a chemical change).

Assessment

Formative: Discussions and Investigative Data Sheet 2: Redesign

Summative: N/A

Elaborate Materials Needed and Website/Other Resources:

Balance for each group (can be found in the FOSS kit)

Water

Vinegar (can be found in the FOSS measurement box)

Baking soda (can be found in the FOSS kit)

Dish (evaporation dishes can be found in the FOSS kit)

Construction Paper (1 sheet per group)



Copy Paper (1 sheet per group)
Ice Cubes (2 cubes per group)
Crayons
Plastic cups (small cups can be found in the FOSS kit)
Investigation Data Sheet
Science Notebooks

EVALUATE:

Start lesson by reviewing the Explore and Elaborate lessons. Have students discuss and share the changes that occurred when they altered some of the original investigations. Ask them to think and share about why these particular changes affected the outcomes so much.

After the discussion portion, let the students know that today they are going to plan out an investigation that would take them through the similar steps of showing mass conservation, change, and a physical and chemical change.

Students will create an investigation plan that will begin with a physical change of matter in which mass is conserved, how mass can change, as well as demonstrating both a physical change in matter and a chemical change in matter. You may have students use the materials that you have in the FOSS kit (or whatever materials you have as a resource if you are not using FOSS) or have them bring in materials from home (provided that they are safe to use in the classroom).

Students will then need to create an outlined plan in their notebook that they can then follow to conduct the investigation.

Students will then write an informational paper that supports and provides evidence of their experiment and the process involving both physical and chemical changes.

Assessment

Formative: N/A

Summative: Informative Investigation Papers with Evidence

Evaluate Materials Needed and Website/Other Resources:

Possible Materials for their Investigations (Most all materials can be found in the FOSS kit):

Water

Cups

Balance

Vinegar

Baking Soda

Sodium Bicarbonate

Salt (Kosher and Epsom)

Comments/Teacher Tips:

Substitutions can be made in place of the Alka-Seltzer and Baking Soda as long as a chemical change is occurring.

I find it best to have the Explore and Elaborate parts take place on two separate days.

Lesson Created by Carrie Monday



Science Team