

Physical vs. Chemical Changes Lesson 1: *The Solve* Educator's Resource Guide

Objective

In *The Solve*, students will:

1. Solve a mystery that demonstrates the understanding that unlike physical changes, chemical changes break bonds to create new substances with different properties.
2. Work collaboratively to complete a Mind Map using new terms, definitions, and visuals comprising essential Physical and Chemical Changes vocabulary.

Time Required: 40–75 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
<ul style="list-style-type: none">● Student Guide<ul style="list-style-type: none">○ (includes <i>Student Agenda and Mind Map</i>)● Physical vs. Chemical Changes Comic Book or Motion Comic Episode● Scissors● Glue or tape	None	<ul style="list-style-type: none">● Developing and Using Models● Constructing Explanations or Arguments From Evidence

Mosa Mack Mystery Episode Description

Amir and Gracie are in a panic! Mom specifically asked them to hold off on making food, but Amir couldn't help himself and made a huge breakfast. And now Mom's on her way home! Amir's got to change everything back to the way it was so she doesn't notice anything. When Mosa arrives, she dives into different foods at a molecular level to get a sense of exactly what is going on during the cooking process. Amir and Gracie are in for some good news. . . and some bad news.



Inquiry Scale: Leveling Information

The Solve can be completed in various settings, including presentation-style, small groups, or individually. In the case of a flipped or blended classroom, it can be completed entirely at home.

Level 1: Most teacher-driven (*recommended for grades 4–5*)

View the animated mystery twice: once in full, and a second time along with the discussion questions, pausing the video as needed to answer the episode questions as a group. Project and complete the Mind Map as a class-wide activity. This can be done digitally or on paper. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 2 (*recommended for grades 5–6*)

View the animated mystery in full. Afterwards, have students work through the episode questions to the best of their ability in small groups. Play the mystery a second time, pausing the video to discuss each question. Direct students to complete the Mind Map in small groups, either digitally or on paper. Come back as a class to review correct answers, as needed. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 3 (*recommended for grades 6–7*)

Provide students with their student URL and have students view the animated mystery in small groups. Have students play the animated mystery once in full and then answer episode questions in their table groups to the best of their ability. Then, as a class, project the mystery, pausing, as needed, to discuss episode questions in a think-pair-share format. Have students complete the Mind Map in table groups, either digitally or on paper. Have students quiz each other on the vocabulary until you feel they're familiar with the terms. In table groups, have students go through the discussion questions on their own, and review answers as a class. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4 (*recommended for grades 7–8*)

Provide students with their student URL and have students view the animated mystery and complete episode questions in pairs. Have students review their answers with a neighboring table group. Have students complete the Mind Map in pairs, either digitally or on paper. Have students quiz each other on the vocabulary until they feel they're familiar with the terms. Have these same pairs go through the discussion questions. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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Agenda

I. Solve the Physical vs. Chemical Changes Mosa Mack Mystery (20 minutes)

Differentiation Tip: The comic book and motion comic video can be read/watched as a class, in small groups, individually, or completed for homework. For additional support, students can read or watch the comic/episode twice: once before completing the questions, and once with teacher guidance, pausing to discuss each answer.

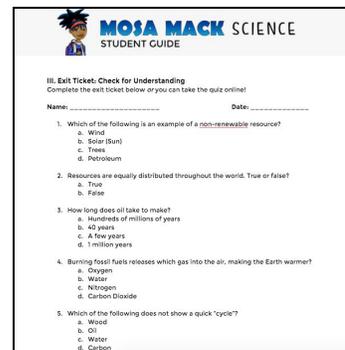


1. Read/watch the Mosa Mack Mystery on Physical vs. Chemical Changes.
2. Students answer the questions in their Student Guide as they read/watch. Encourage students to cite the specific page numbers/time codes in the Comic Mystery to promote writing with supporting evidence. Answers can be found in the key below.

II. Vocabulary Mind Map Activity (15–45 minutes)

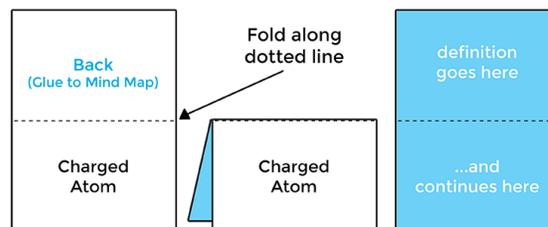
Differentiation Tip: The Mind Map can be done as a class, in small groups, individually, or completed for homework.

1. Students may complete the Mind Map **digitally**. Follow directions below. (15 minutes)
 - a. Go to



<https://mosamack.com/home/chemical-physical-changes>

- b. Select **Lesson 1: The Solve**.
 - c. Select **Vocabulary** and complete **Part 1**: matching terms with definitions.
 - d. Complete **Part 2**: matching terms and definitions with images on a diagram.
2. To complete the Mind Map **on paper**, follow the directions below (45 minutes).
 - a. Print and pass out the Student Guide: Physical and Chemical Changes Lesson 1: *The Solve*.
 - b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Physical vs. Chemical Changes unit.
 - c. Model the directions carefully, emphasizing the following. Students should:
 - **cut** out the vocabulary cards on the solid lines only
 - **fold** the cards at the dotted lines
 - write the definition of the term on the inside of the card using definitions provided
 - d. Students use the clues from the Mind Map images, definitions, and terms to place the cards in the correct location in the Mind Map.



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- e. Check that the students have matched their cards correctly before moving on.
- f. Students use glue or double-sided tape to connect the back of the vocabulary card to the correct place on the Mind Map.
- g. Students discuss the questions with their group or as a class when they have completed the Mind Map.

Teacher Tips:

- Since this is the first time many of the students will have seen these vocabulary terms, have students work together to use the images, definitions, and collaborative thinking to figure out where the terms go.
- Check in on student groups through this process. When you see a student or group who has placed a card in the correct place, ask a facilitating question such as, “Why do you think that term goes there?” or “What evidence leads you to believe that term goes there?” When students explain their thinking, this is a great opportunity to provide positive reinforcement. Then, encourage students to share their reasoning to the class or to other groups who may have trouble identifying the location of that specific term.
- If you do not have access to a color printer, provide students with black and white copies and project the colored version of the Mind Map at the front of the room so that students can reference both images.

III. Exit Ticket: Check for Understanding (10–15 minutes)

Differentiation Tip: This can be done in groups, pairs, individually, or more formally as a quiz online.

1. Students complete the exit ticket to check for understanding. This can be done online by selecting the **Quiz** button in Lesson 1 or on paper in the Student Guide. Answers are in the key below.

Answer Key

Mind Map Discussion Questions

1. Which cooking process(es) show a substance staying the same substance? *Chopping the chocolate bar into flakes and mixing the chocolate into the batter*
2. Which cooking process(es) show a substance changing into a new substance? *When the batter is baked in the oven*
3. When you bake cookies in the oven, what changes do you notice between the dough and the finished cookies? Think about what you see, touch, taste, and smell. *The dough changes color, becomes hard, and gives off a sweet smell.*

Episode

1. Amir and Gracie left some evidence of breakfast behind. Luckily, some of it can be changed back. What does Mosa write down as clues that a substance will easily change back? (Pages 2 and 9) (Time code-1:30 and 5:53)

Change in shape, change in size, and the molecules stay the same.

2. Where is the water in the pot going? Is it disappearing? (Page 3) (Time code- 1:41)

*Water isn't disappearing; it's just changing form, going from **liquid** to **gas**.*

3. How does E. Mulsion, celebrity food scientist, define a physical change, and what examples does he give? (Page 4) (Time code- 2:34)

Physical changes are when the molecules in a substance stays the same before and after. The deflating Moo-Moo and the orange getting juiced are both physical changes.

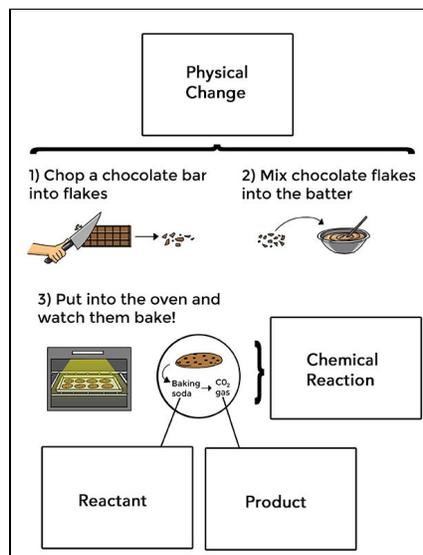
4. Why is unfrying the eggs impossible? (Pages 5–6) (Time code- 3:22)

*Frying eggs is a **chemical reaction**. In a chemical reaction, the molecules inside the egg have been changed, so we can't change it back.*

5. As Mosa studies eggs and toast, what does she write down in her notebook as indicators of chemical reactions? (Pages 6–8) (Time code- 4:41)

Answers include: Color change, smells, absorbs or gives off heat, texture change, bubbling and fizzing, molecules change, can't change back to its original form.

Mind Map



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6. How is lighting a match an example of a chemical reaction? (Page 8) (Time code- 5:01)

When a wooden match is lit, its molecules (mostly cellulose) change. For students who would benefit from an additional challenge, encourage them to research the specific reaction. The cellulose will change to smoke composed of water vapor and carbon dioxide gas as well as carbon (ash).

7. How is the dissolving antacid tablet an example of a chemical reaction? (Page 9) (Time code- 5:28)

Sodium bicarbonate and citric acid react in the water to create carbon dioxide gas, which we see as bubbles.

8. What did Mosa figure out? Why can't they get back the eggs and the bread? Why can't they turn the pancakes back into the original ingredients? (Answer Comic)

The molecules inside the egg and bread are changed by a chemical reaction. The egg whites changed from a clear jelly to white. The bread changes color and texture as well as giving off a smell. When Billy made the pancakes, the pancakes bubbled, changed color, and gave off a smell: this means that the ingredients went through a chemical reaction, which is not easily reversible!

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Quiz:

- Which of the following is NOT an indicator of a physical change?
 - A substance changes shape
 - A substance changes form
 - The change is easily reversible (it can change back)
 - A substance fizzes and bubbles**
- You're about to make macaroni and cheese! First, you boil a pot of water. The boiling water is an example of a:
 - Physical change**
 - Chemical reaction
- In a physical change, the molecules inside a substance _____ before and after.
 - Stay the same**
 - Change
 - Vary between
 - Travel between
- Toasting marshmallows over a campfire is an example of a:
 - Physical change
 - Chemical reaction**
- In a chemical reaction, molecules in the substance _____ before and after.
 - Stay the same
 - Change**
 - Vary
 - Travel