

Matter and Its Interactions Lesson 1: *The Solve* Educator's Resource Guide

Objective

In *The Solve*, students will:

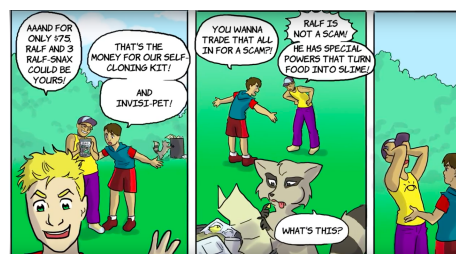
1. Create a Mind Map to explore vocabulary related to Matter and Its Interactions.
2. Watch an animation about matter to understand the indicators for a chemical change.
3. Do an experiment to investigate the conservation of weight during a chemical change.
4. Complete an exit ticket to demonstrate an understanding of key concepts.

Time Required: 50–60 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
<ul style="list-style-type: none"> • Student Guide (<i>includes student agenda and Mind Map</i>) • Matter and Its Interactions Comic • Computer with speakers • Scissors • Glue or tape • Materials per group of 3–4 students: <ul style="list-style-type: none"> ○ 1 Alka-Seltzer tablet ○ Ziploc bag ○ 50-mL of water ○ Beaker or cup ○ Scale 	None	<ul style="list-style-type: none"> • Planning and Carrying Out Investigations

Episode Description

Felix and JoJo have been saving their change to buy a self-cloning kit or an Invisi-Pet, but a lot of their friends have bought Ralf. Ralf is the world's first slime bot—when he eats Ralf Snax he vomits out something else! JoJo thinks that Ralf is creating a new substance, but Felix is not so convinced. They investigate this phenomenon by going back into the Mosa Mack files to see how Mosa has solved this type of mystery in the past. They embark on an adventure to figure out what is really happening when Ralf eats his Ralf Snax and what kind of evidence they can collect to prove it!



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*)

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.

Then, read/view the animated mystery twice: once in full, and a second time along with the discussion questions, pausing the video/reading as needed to answer the episode questions as a group. Next, perform the Alka-Seltzer activity as a demonstration and answer the discussion questions as a class. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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

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.

Then, read/view the animated mystery in full. Afterwards, have students work through the episode questions to the best of their ability in small groups. Play/read the mystery a second time, pausing the video/reading to discuss each question. Next, perform the Alka-Seltzer activity as a demonstration and answer the discussion questions in small groups. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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

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.

Provide students with their student URL and have students view the animated mystery (or read, if comic) in small groups. Have students play/read 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/read the mystery, pausing, as needed, to discuss episode questions in a think-pair-share format. Next, perform the Alka-Seltzer activity in small groups and answer the discussion questions in small groups. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4 (recommended for grades 7–8)

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. Provide students with their student URL and have students view the animated mystery (or read, if comic) and complete episode questions in pairs.

Have students review their answers with a neighboring table group. Next, perform the Alka-Seltzer activity and answer the discussion questions in small groups. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Agenda

I. Warm-Up: Vocabulary Mind Map (15–45 minutes)

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

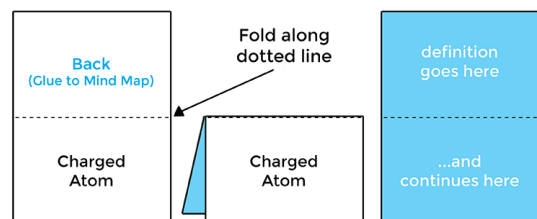
1. Students may complete the Mind Map **digitally**. To do so, follow the directions below (15 mins)
 - a. Go to <https://mosamack.com/home/matter-interactions>
 - b. Select **Lesson 1: The Solve**.
 - c. Select **Vocabulary** and complete **Part 1**: matching terms with definitions.
 - d. Complete **Part 2**: matching terms and definitions with images on a diagram.

2. To complete the Mind Map **on paper**, follow the directions below (45 mins).

- a. Print and pass out the Student Guide: Matter and Its Interactions Lesson 1: *The Solve*.
- b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Matter and Its Interactions 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.
- 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.

Mind Map Answers

Students discuss the questions with their group or as a class when they have completed the Mind Map.

1. What did Felix and JoJo each think about Ralf and Ralf Snax? *Felix thinks that Ralf is a scam and that Ralf Snax are everyday materials like glue. JoJo thinks that Ralf has magical powers and that he can turn Ralf Snax into slime.*
2. What kind of chemical change did Felix and JoJo see after Ralf ate his Snax?
After Ralf ate his Snax, Felix and JoJo saw that the new material was bubbly and fizzy. It also changed color!
3. Connect the chemical change you witness in the *The Solve* to other chemical changes you have seen before. Give evidence of examples!
I have seen chemical changes similar to The Solve when I have helped my parents cook or bake. The materials bubble and fizz and change color! You also can't change them back to their original state. I have also seen it at a bonfire, when burning a candle, and when a banana ripens.

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.

II. Solve the Matter and Its Interactions Felix and JoJo 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 Felix and JoJo Mystery on Matter and Its Interactions.
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.

III. Conservation of Mass in Matter (30–35 minutes)

If teaching this remotely, view the video link [here](#) for the investigation.

Hook: The scientists at NASA have discovered a notebook with instructions to create a new substance. It seems that they are making an interesting claim about mass before and after combining the materials. The scientists claim that when substances are combined, the total mass will stay the same. They have asked you to follow the directions and write your observations about what happens!

Directions

1. Read the instructions below.
2. Write your claim based on the instructions.
3. Carry out the instructions.
4. Write your evidence and reasoning after following the instructions.
5. Answer the discussion questions in your group.

Directions:

1.	Measure out 50mL of water and pour into a beaker or cup.
2.	Find the mass of the 50mL of water in the beaker, the alka seltzer tablet and the ziplock plastic bag and record in the table. (mass in grams)
3.	Without spilling the water, place the beaker into the ziplock bag and place the tablet into the bag without getting it wet. Place the tablet as far away from the beaker as you can.
4.	Push the remaining air out of the ziplock and seal the bag.
5.	With the bag closed, carefully move the alka seltzer tablet into the beaker of water. Observe for 90 seconds. While still in the bag, tap the beaker a few times.
6.	After the reaction stops, weigh the bag and beaker again. Record in table.

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1: Mass **Before** Experiment

Item	Mass (in grams) Trial 1	Mass (in grams) Trial 2	Mass (in grams) Trial 3
Water in Beaker	161 grams	161 grams	161 grams
1 Alka-Seltzer Tablet	3 grams	3 grams	3 grams
Ziploc Bag	2 gallon ziplock bag 19 grams	2 gallon ziplock bag 19 grams	2 gallon ziplock bag 19 grams
Total Mass	183 grams	183 grams	183 grams

Table 2: Mass **After** Experiment

Total Mass	183 grams	183 grams	183 grams
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Observations

<p>Claim: An assertion; a statement believed to be true.</p> <p><i>Make a claim about the mass of the items in this activity before and after combining them.</i></p>	<p><i>The scientists claim that when substances are combined to make a new substance, the total mass will stay the same.</i></p>
<p>Evidence: Scientific data used to support the claim.</p> <p><i>What evidence was presented in the activity to support the claim?</i></p>	<p><i>The total mass of the substances before the chemical reaction was 183 grams.</i></p> <p><i>The total mass of the substances after the chemical reaction was 183 grams.</i></p> <p><i>The alka seltzer tablet reacted in the beaker of water. Air filled the inside of the zip lock bag as a result of this reaction.</i></p>

<p>Reasoning: Connects the evidence to the claim.</p> <p><i>How does the evidence support the claim?</i></p>	<p><i>When substances are combined to make a new substance, the total mass will stay the same. In this reaction, alka seltzer reacted in water and air filled the inside of the zip lock bag. The original substances changed, but the total mass before the reaction was the same as the total mass after the reaction. This proves that matter can change during a chemical reaction, but is not lost.</i></p>
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Discussion Questions

- Did the mass of your items change between your two measurements (before and after the reaction)? What does that tell you about how chemical change impacts weight?

The mass of my items didn't change (or changed very minimally) between my two measurements (before and after the reaction). When chemical reactions happen—even if they look dramatic—they do not impact the mass of the parts and the total mass overall because nothing is created or destroyed in the process of the chemical reaction/change.

- What are some examples where you have seen a chemical change and the mass has stayed the same?

Answers may vary. When you burn wood during a bonfire, the mass of the ashes and remnants is the same as the original wood. When you light a candle and the candle melts, the overall mass that's left is the same because none of the matter has disappeared.



IV. Exit Ticket: Check for Understanding
Complete the exit ticket below or you can take the quiz online!

Name: _____ Date: _____

- Sound energy can be produced by which of the following objects below?
 - Drum
 - Flashlight
 - Copper Wire
 - Battery
- Heat would be present in which example(s) below?
 - A stove heats up a pot of water.
 - The sun melts an ice cream cone on a hot summer day
 - A flame heats a log in a fire
 - All of the above
- There are many types of energy, including:
 - Heat
 - Sound
 - Light
 - All of the Above
- When a copper wire is connected to a battery and light bulb, the light bulb glows brightly. In this example, electrical energy converts to light energy. This example shows us that:
 - Energy can never change forms
 - Energy can change from one form to another
 - Energy can only be transferred through electricity
 - Energy can only be transferred through sound
- True or False: Energy can change from one form to another.
 - True
 - False

IV. 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.

- 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

Episode Questions

1. What is the initial problem that Felix and JoJo are trying to solve?

Felix and JoJo are trying to determine if the claim made about Ralf is correct—that as the world's first slime-bot he can turn food into slime. (Page 2, :58 in the video.)

2. What is the claim about Ralf?

It seems that when Ralf eats, he creates a brand new substance after robo-gestion. (Page 2, 1:30 in the video.)

3. Explain how Felix and JoJo tried to observe physical properties to determine what Ralf Snax was.

Felix and JoJo first looked at each individual part of Ralf Snax to see if they could identify a material or object that was similar to something they had seen before. They were able to use physical properties to identify a magnetic material, something similar to snow, etc. (Pages 3–4, 1:44–3:01 in the video.)

4. Why does Felix win Round 1?

Felix said that all the materials that Ralf is eating (his Ralf Snax) are nothing special. The materials were identifiable through some observation and experimentation to be normal, everyday things like baking powder, magnets, and glue. Therefore, JoJo doesn't think that Ralf is worth the cost. (Page 4, 2:58 in the video.)

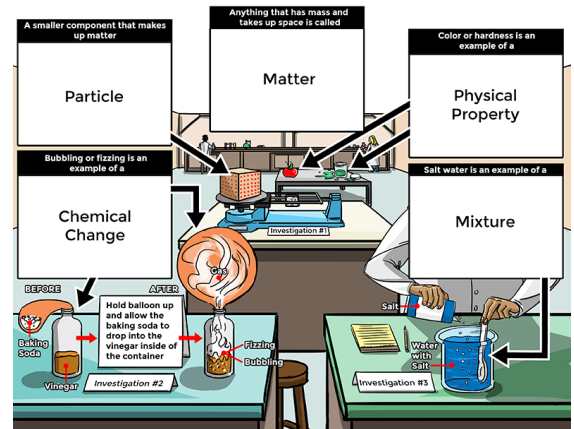
5. JoJo thinks that Ralf is making something completely new out of the ingredients in Ralf Snax. Explain how this is related to the Mosa Mack files about un-making breakfast.

JoJo claimed that when Ralf eats Ralf Snax he is able to create a brand new substance. JoJo was able to prove his claim because they looked at each individual ingredient in the Ralf Snax package before he ate them and observed what materials came out during Robo-Gestion. The items that he ate were nothing like what came out of him! (Page 6, 4:10 in the video.)

6. What did Felix and JoJo figure out?

Felix and JoJo figured out that even though Ralf was eating normal, everyday materials, he was creating a brand new substance! They were able to learn this because they learned about chemical changes and learned that they could identify chemical changes through specific properties. When Ralf had Robo-Gestion, there were bubbles, a new color, and the substance couldn't change back to the original Ralf Snax. (Page 8, 5:49 in the video)

Mind Map



Quiz:

1. A chemical change occurs when which of the following is true:
 - a. Light is reflected off the material
 - b. Bubbles or fizz occur**
 - c. You can separate the materials back to their original state
 - d. A substance is dissolved in water
2. Mixing two or more substances together without producing a new substance is an example of a physical change.
 - a. True**
 - b. False
3. When you combine two or more substances and something new is created that is an example of:
 - a. Physical change
 - b. Chemical change**
 - c. Physical properties
 - d. Matter
4. Which of the following are examples of a physical property?
 - a. Transparency**
 - b. Measurement
 - c. Electrical Conductivity**
 - d. Amount
5. You separately weigh a cup of water and a pile of sugar. If you mix the sugar into the cup of water, the overall weight of the cup + water + sugar will be the same as the sum of the individual components.
 - a. True**
 - b. False