

States of Matter Lesson 1: “The Solve”

Educator’s Lesson Plan

The Solve contains two mini lessons: The [live video lesson](#) and the [animation lesson](#) For the most comprehensive learning experience, conduct both. If you’re short on time, choose one. Which lesson?

- For a more structured lesson, choose the animation (the lesson below).
- For a more inquiry-based lesson, choose the live video lesson and assign the animation for homework.

Objective:

In The Solve, students will:

1. Solve a mystery that demonstrates why a substance in different states can behave so differently.
2. Create a mind map to explore relationships among complex vocabulary relating to states of matter.

Time Required: 45-80 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
<ul style="list-style-type: none">• Student Guide (<i>includes student agenda and vocabulary handout</i>)• States of Matter Episode• Computer with speakers• Scissors• Glue or Tape	None	<ul style="list-style-type: none">• Developing and Using Models• Constructing Explanations or Arguments From Evidence

Episode Description:

The birds are furious! Humans, they claim, are paving over their lake every winter with a “white tar” and then stealing their lake water for the swimming pool nearby. Mosa Mack, as a representative of the human race, is pinned with the crimes. Mosa and her team take the year to gather evidence and discover that molecules in different states may be the cause behind the suspicious lake!



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 States of Matter Video Mystery (20 minutes)

Differentiation Tip: The Video Mystery can be viewed as a class, in small groups, individually, or completed for homework. For additional support, students can view the episode twice: once before completing the questions and once with teacher guidance, pausing the video to discuss each answer.

1. Play the animated Mosa Mack Mystery on States of Matter.
2. Students answer questions either digitally on the Mosa Mack platform or on paper in the Student Guide as they watch. Encourage students to cite the specific time codes in the episode to promote writing with supporting evidence. Answers can be found in the key below.
3. View the answer video to confirm student understanding.

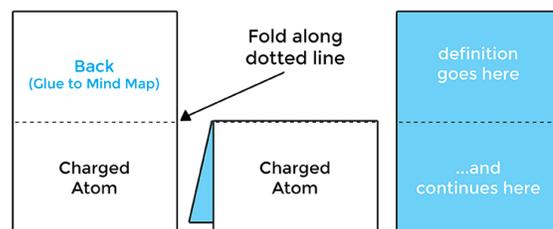


II. Vocabulary Mind Map Activity (15–45 minutes)

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

1. Students may complete the Mind Map **digitally**. Follow the directions below. (15 minutes)
 - a. Go to <https://mosamack.com/home/states-of-matter>
 - 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: States of Matter Lesson 1: *The Solve*.
- b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this States of Matter 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.

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- Students use glue or double-sided tape to connect the back of the vocabulary card to the correct place on the Mind Map.
- 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 throughout this process. When you see students or groups who have placed their 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 them 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 Mind Map at the front of the room so that students can reference both images.

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

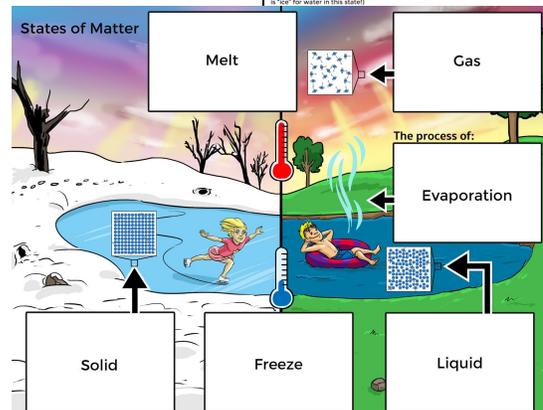
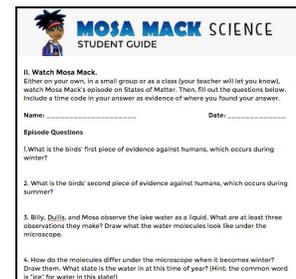
Differentiation Tip: This can be done in groups, pairs, individually, or more formally as a quiz online.

- 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 Answer Key section below.

Answer Key

Episode Questions

- What is the birds’ first piece of evidence against humans, which occurs during winter?
The humans use a machine to pave a “white tar” over the lake during winter.
- What is the birds’ second piece of evidence against humans, which occurs during summer?
The water level of the lake goes down every summer when the pool is filled. There is a pipeline that appears to go from the lake to the swimming pool.
- Billy, Dullis, and Mosa observe the lake water as a liquid. What are at least three observations they make? Draw what the water molecules look like under the microscope.
The water can be pushed through. It takes the shape of the container. There is space between the molecules. The molecules are sliding past each other.



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4. How do the molecules differ under the microscope when it becomes winter? Draw them. What state is the water in at this time of year? (Hint: the common word is “ice” for water in this state!)

The molecules slow down when it becomes winter, barely vibrating as they pack tightly together. During winter time, the water is a solid.

5. What is the “white tar”? What causes it every year?

The white tar is ice, caused by the cold temperatures every winter.

6. What happens to the liquid propane when it hits the warmer air? Draw what the molecules look like under the microscope.

The molecules increase in speed and spread out in the larger area, becoming a gas.

7. Help Mosa solve the mystery. Where is the water from the lake going during summertime?

Because of the higher temperatures in summer, the water is evaporating into the air and becoming a gas.

Quiz:

- Which of the following describes a liquid?
 - The molecules are tightly packed.
 - The molecules do not move.
 - It can take the shape of whatever container it is in.**
 - It is invisible.
- What process describes water going from a solid to a liquid?
 - Freezing
 - Melting**
 - Evaporating
 - Sublimating
- Which of the following does **not** describe a solid?
 - The molecules slide past each other.**
 - The molecules are tightly packed, vibrating slightly.
 - Ice is an example.
 - It keeps its shape in a container.
- What happens to the motion of molecules when they are heated?
 - They move faster.**
 - They move slower.
 - They stay the same speed.
 - The motion doesn't change; there are just more molecules.
- Which of the following is true about when the liquid propane transformed into a gas? Choose all that apply.
 - The warmer outside temperature caused it.**
 - The process is called freezing.
 - The molecules spread farther apart.**
 - The process is called evaporation.**