# 2nd Grade Instructional Unit: Matter

## Objectives and Multiple Choice Questions

**Learning Objective:** *Students will identify the three states of matter: solids, liquids, and gases according to their properties.*

1. **Which state of matter has a definite shape?**
   - A. Gas  
   - B. Liquid  
   - C. Mass  
   - D. Solid

2. **Which two states of matter have a definite volume?**
   - A. Liquid and gas  
   - B. Liquid and mass  
   - C. Solid and gas  
   - D. Solid and liquid

**Learning Objective:** *Students will identify the three basic properties of matter: volume, mass, and shape.*

3. **What are the three basic properties of matter?**
   - A. Volume, mass, and shape  
   - B. Color, size, and weight  
   - C. Solid, liquid, and gas  
   - D. Freezing, melting, and boiling
## Objectives and Essay Questions

### Short Answer:

<table>
<thead>
<tr>
<th>Learning Objective: Students will identify the three states of matter: solids, liquids, and gases according to their properties.</th>
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<tbody>
<tr>
<td>1. Name the three states of matter and give an example of each.</td>
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<td><strong>solid-ice, liquid-juice, gas-helium</strong></td>
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<td>2. Define matter.</td>
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<td><strong>Anything that has mass and takes up space</strong></td>
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<table>
<thead>
<tr>
<th>Learning Objective: Students will identify the three basic properties of matter: volume, mass, and shape.</th>
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<tr>
<td>3. Explain the difference between volume and mass.</td>
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<td><strong>Mass is the amount of matter an object contains, while volume is how much space it takes.</strong></td>
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Learning Objectives:

*Students will identify the three states of matter: solids, liquids, and gases according to their properties.*

*Students will describe the three states of matter: solids, liquids, and gases according to their properties (ex. size, shape, color, smell, sound).*

1. Identify and describe the three states of matter that you see in this picture.

![Birthday Cake and Balloons](image)

Learning Objectives:

*Students will infer what changes different elements (heat, cold, water, etc) will cause to states of matter.*

2. Mary went to the park on a hot day. She put a cup of ice on a picnic table while she went to play on the playground. When she got back, she could only find a cup of water. Mary blamed her friend for stealing her cup of ice, but her friend promised she didn’t touch it. Based on what you know about how matter can change states, explain what may have happened to Mary’s ice.

3. Describe an experiment using chocolate that could help teach students about how matter can change from one state to another.
### Objectives and Higher-Order Thinking Questions

**Learning Objective:** Students will identify the three states of matter: solids, liquids, and gases according to their properties.

| 1 | Sam is sitting in her kitchen while her mom is cooking her favorite meal, spaghetti. Sam is learning about matter in her 2nd grade class, so she tells her mom about the different states of matter that she is observing in the kitchen. What examples of matter might Sam tell her mom about?  

*Give at least one example of each state of matter that Sam is likely seeing in the kitchen. Compare and contrast the states of matter of the examples that you identify.* |

**Learning Objective:** Students will infer what changes different elements (heat, cold, water, etc) will cause to states of matter.

| 2 | Joe’s little brother, Tom, is excited about going back to his grandpa’s mountain cabin in January. Tom had a fun time fishing at a little pond when he visited last summer, and he can’t wait to see what he catches this time! Joe tells Tom that he should probably bring his ice skates instead of his fishing pole. Why do you think Joe said this to his little brother?  

*Use your knowledge of how changing elements can effect states of matter to explain your thinking.* |

**Learning Objectives** Students will describe the three states of matter: solids, liquids, and gases according to their properties (ex. size, shape, color, smell, sound).
3 The students in Mrs. Williams’ class are going to play the game, “Guess What’s the Matter”. Students must describe an object using the item’s properties and their partner will try to guess what the object is. Billy pulls a card and describes it as follows: “This item smells sweet and tastes sugary and buttery. It is tan and white. It is soft, sticky, and squishy to touch. It does not have a definite shape.” After several failed guesses, he tells his partner, Jen, that the item was a cinnamon roll. Jen argues, saying that Billy made a mistake describing the properties of the cinnamon roll. Justify why Jen is correct in stating that Billy made a mistake. Infer what concept about properties Billy is having trouble understanding.

Possible response: *The cinnamon roll is a solid and all solids have a definite shape. You can change the shape of a solid by applying force. Billy may have thought the cinnamon roll didn’t have a definite shape because he could poke his fingers in it or take a bite of it, which would change its shape.
## Objectives and Performance Assessment Items

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<tr>
<th>Learning Objective: Students will identify the three states of matter: solids, liquids, and gases according to their properties.</th>
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<tbody>
<tr>
<td>EQ: What are real-world examples of each state of matter?</td>
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<th>Learning Objective: Students will infer what changes different elements (heat, cold, water, etc) will cause to states of matter.</th>
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<tbody>
<tr>
<td>EQ: Do different liquids react exactly the same to different elements?</td>
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<tr>
<th>Learning Objectives Students will describe the three states of matter: solids, liquids, and gases according to their physical properties (ex. size, shape, color, smell, sound).</th>
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<tr>
<td>EQs: Can you make a solid change shape? Is a solid always hard?</td>
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<td>3</td>
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Assessment Plan

Improving item reliability:

Reliability is the “degree to which students’ results remain consistent over replications of an assessment procedure. Reliability is a necessary but not sufficient piece of evidence to support the validity of test score interpretations and the quality of educational decisions based on them” (Educational Assessment of Students, Pg. 66). To improve item reliability, I must ensure that my assessments are of sufficient length and that an appropriate amount of time has been allotted for students to complete the assessment. In reviewing student performance on test items, I should be able to see individual students perform consistently from item to item. Furthermore, I can have a colleague grade items using the scoring rubric as well, and I can then compare our scores, or we can score them together. If I find discrepancies, I will know that I need to improve my items’ reliability.

• Multiple Choice: The reliability of multiple choice items can be affected by students’ ability to guess on items. I can increase the number of items to reduce the chance of accurate blind guessing. I can also increase the number of questions that assess a single learning objective. To further improve item reliability, I must ensure that my assessments are of sufficient length and that an appropriate amount of time has been allotted for students to complete the assessment. In reviewing student performance on test items, I should be able to see individual students perform consistently from item to item.

• Essay: My short answer questions are reliable because they involve students listing and defining factual information. These items can not be interpreted in differing ways. My essay items will be harder to score. I should use a scoring rubric to improve the reliability, or consistency, of my scoring. I can also cover up students’ names in order to avoid grading students using differing criteria.

• HOT: The HOT items require written response, therefore, I should use a scoring rubric to improve the reliability, or consistency, of my scoring. The rubrics will help to ensure that I am
grading the items correctly and only on the concepts relating to the specific learning objectives being assessed. I can also cover up students’ names while grading in order to avoid grading students using differing criteria.

- **Performance:** My performance assessment items are reliable because they involve concepts that will have been clearly defined and discussed during the unit. I used real-world situations and items that should be familiar to all of my students. These items allow students to demonstrate their higher-order thinking skills within a realm of possibilities that are age and developmentally appropriate. Because of the nature of these items, I will need to create a high-quality scoring rubric that “allows for the multiplicity of ways students might accomplish open-ended tasks” (Bookhart & Nitko, 2015).

**Improving item validity:**

Validity is the “soundness of your interpretations and uses of students’ assessment results” (Educational Assessment of Students, pg. 37). To improve item validity, I can consider a number of different factors. Firstly, have I aligned my assessment tasks to the Georgie Science standards and curriculum framework? Secondly, am I assessing important learning outcomes and using a variety of assessment formats? Additionally, are my assessments an appropriate length and difficulty for my 2nd grade students? Furthermore, I should review my test items against the validity criteria. Finally, I can create an assessment blueprint, which will help me to ensure that I have included and covered the intended content in a balanced way.

- **Multiple Choice:** *See above*

- **Essay:** Essay items are a challenge to score reliably, which in turn lessens the validity of these test items. Using a scoring rubric to grade essay items will help to improve the validity of scores. Also, because short-answer and essay items take longer to complete, I may need to spread out assessment items over several days. This would allow me to more comprehensively assess the unit content, which would increase the validity of my assessment.
• **HOT:** My higher-order items require a written response, therefore using a scoring rubric to grade the items will help to improve the validity of scores. Also, because these items take longer to complete, I may need to spread out assessment items over several days. This would allow me to more comprehensively assess the unit content, which would increase the validity of my assessment.

• **Performance:** Performance assessment items are a challenge to score reliably, which in turn lessens the validity of these test items. Because performance assessment items are difficult to assess, using a high-quality scoring rubric to grade the items will help to improve the validity of scores by clarifying the standards of achievement I want to evaluate. Also, because these tasks take longer to complete, I will need to plan for several days to administer them. Furthermore, by defining quality levels and an achievement scale, I will better understand how to assess my students’ achievement on a continuum of educational growth.

**Differentiation of instruction:**

Adjust pacing; reteach when necessary; assign independent tasks to accelerated learners; small group instruction for struggling learners; use a variety of instructional techniques, oral instruction, hands-on learning tasks, written response, collaborative groups, student choice. Furthermore, I can adjust formative assessments to allow students to either write, draw, or verbally explain their understanding. The use of a class video diary/online portfolio will help in collecting evidence of student learning.

• **Multiple Choice:** To further differentiate multiple choice items, I can remove one or two choices from assessment items for students who require intervention strategies for support. I can also alter the wording of my questions to make them easier to read for struggling readers. Likewise, I could use more difficult choices to challenge my accelerated students.

• **Essay:** To differentiate assessment items, I may need to alter the test items in various ways depending on my students’ needs. I may need to simplify or shorten the questions or provide a word bank to be used in essay responses. It may be necessary to alter the text to help emphasize important information. Some students may require items to be read aloud or may need to
respond orally to items. I can also let students complete short-answer and essay item on the computer, particularly if they struggle with writing with pencil and paper.

- **HOT**: To differentiate assessment items, I may need to alter the test items in various ways depending on my students’ needs. I may need to simplify or shorten the questions or provide a word bank to be used in the responses. It may be necessary to alter the text to help emphasize important information. Some students may require items to be read aloud or may need to respond orally to items. I can also let students complete the higher-order thinking items on the computer, particularly if they struggle with writing with pencil and paper.

- **Performance**: To differentiate assessment items, I may need to alter the items in various ways depending on my students’ needs. I may need to simplify the performance tasks by reducing the requirements or number of tasks associated with each performance assessment. For example, in Task #2, rather than comparing three liquids, a student may compare two. Or, in Task 3, students may have a smaller selection of items to investigate and alternative ways to present their findings and strategies, such as using a computer, particularly if they struggle with writing with pencil and paper. Finally, I may need to group some students based on their specific needs, or have them work on an otherwise independent task with a partner.

**Improving student learning:**

A pre-test will allow me to gain insight into students’ beliefs and experiences with the content. I can improve student learning by using this information to develop and guide discussions and address student misconceptions. I will actively question my students to gauge their understanding. If it becomes evident that my students are not comprehending the content, I will adjust my instruction and reteach where necessary. If only a small number of students are struggling with concepts, then I will pull them for small group instructions while the remainder of the class works on independent tasks.

Furthermore, students will have an opportunity to be actively involved in their learning. Building from assigned discovery tasks, students will be encouraged to form their own hypotheses. Working in collaborative groups, students will also be encouraged to work together to devise
hypotheses and mini-experiments. By conducting ongoing formative assessments, I can help to ensure that my students are actively engaged and involved in their learning. These will also keep me informed of the need to differentiate instruction, thereby allowing me to maximize the effectiveness of each lesson.

- **Multiple Choice:** *See above*

- **Essay:** I can use the results of assessment items to adjust and improve my instruction, thereby improving student learning.

- **HOT:** I can utilize a checklist to aid in monitoring an identified set of behaviors exhibited by my students. I can use this checklist to help better understand the critical thinking skills my students are actively using and identify those that I need to help actualize within my students. I can also use a rating scale to record my judgements of my students’ dispositions towards certain critical-thinking behaviors. The checklist and rating scale would act as tools to help me improve students’ critical higher-order thinking skills.

- **Performance:** I can utilize a checklist to aid in monitoring an identified set of behaviors exhibited by my students. I can use this checklist to help better understand the skills (procedure, product, or behavior) my students are actively using and identify those that I need to help actualize within my students. I can also use a rating scale to record my judgements of my students’ dispositions towards certain critical-thinking behaviors. The checklist and rating scale would act as tools to help me improve students’ critical higher-order thinking skills.

**Improving future assessments**

**(Multiple Choice, Essay, HOT, and Performance Items):**

I believe the use of test blueprints and assessment plans will assist in improving future assessments. By utilizing past years’ documents, I can work towards creating a bank of assessments that are valid and reliable. I can use the results of assessment items to adjust and improve future assessments where deemed necessary.