

This formative assessment probe was developed for second grade students with the topic of differentiating between solids and liquids in mind. The NGSS Disciplinary Core Idea standard addressed comes from the physical science section for second grade:

**PS1.A: Structure and Properties of Matter:** *Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties* (NGSS Lead States. 2013).

In order to teach this science topic, teachers need to understand student misconceptions. One of these misconceptions is that a solid must be something that is hard and breakable into chunks (Victoria State Government, 2018); students have a hard time categorizing substances like powders as solids and usually distinguish them as liquids (Victoria State Government, 2018). Another misconception that students have is that condensation occurs when air turns into a liquid (Fries-Gaither, 2008). A final misconception that teachers should be aware of is that materials can only exhibit properties of one state of matter (Riley, 2014). These misconceptions are essential in understanding the prior knowledge that students might have on the topic. Within this formative assessment probe, some items were included to address those misconceptions (powder substances, condensation, and items that have characteristics of more than one state) and to provide an opportunity for discussion following the completion of the probe.

After an analysis of the student misconceptions, a teacher must be aware of the essential content that they will need to address with their students in relation to this topic. To explore states of matter, students first need an understanding of what matter is. For this lesson, the teacher needs to introduce students to the idea that matter exists all around us and it appears in “states” of solid, liquid, and gas which can be altered through adding or taking away heat (BrainPOP, 2018). There are resources that exist to help introduce students to matter as well as the states of matter and their characteristics (BrainPOP, 2018). This discussion needs to be integrated into the lesson following the assessment probe.

Another important piece of content background knowledge essential for this lesson is the idea that states of matter have characteristics that make them easier to identify (BrainPOP, 2018). In addition, some items have characteristics of more than one type of state (BrainPOP, 2018). This understanding relates to one of the misconceptions addressed above, and that is why it is essential information for the teacher to understand and address with her students during this topic. Making the characteristics easily understood by providing examples of solids and liquids that follow these characteristics along with some that do not will create an opportunity for conversation in the lesson on these tricky concepts for students.

This formative assessment probe is given in the engagement phase or the opening to the lesson. The purpose of the probe is to gather student prior knowledge and alter teaching based on the data collected. With this probe, the teacher is looking for common errors in identifying solids and liquids. It may also be beneficial to have a conversation with students after completion about why they made the choice that they did (in a whole-class or small-group discussion). The errors in understanding that students make will influence the lesson as the teacher will be sure to target those first (such as problems with materials having characteristics of two states). Gaining an understanding of student ideas before the lesson helps the teacher to see what incorrect ideas exist that need to be proven incorrect through the lesson activities.

# Solids and Liquids



Name: \_\_\_\_\_

Color the pictures that are solids red. Then, color the liquids blue. When you are done, turn and talk to a neighbor about why you colored the pictures the way you did.

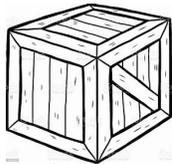
Solids



Liquids



1.



box

2.



water

3.



pencil

4.



paint

5.



rock

6.



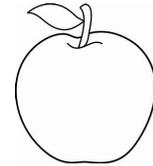
book

7.



syrup

8.



apple

9.



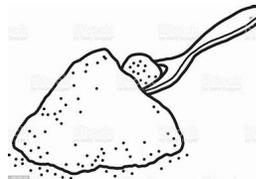
soap

10.



lemonade

11.



salt

12.



coffee

13.



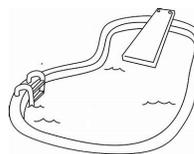
bread dough

14.



chalk

15.



pool

16.



bear

17.



Pop

18.



ball

19.



milk

20.



soup

When you are done, turn and talk with a neighbor about your answers!



## References

BrainPOP. (2018). *Changing states of matter background information for teachers and families*.

BrainPOP Educators.

<https://educators.brainpop.com/lesson-plan/changing-states-of-matter-background-information-for-teachers-and-families/>

Fries-Gaither, J. (2008). *Common misconceptions about states and changes of matter and the water cycle*. Beyond Penguins and Polar Bears.

<https://beyondpenguins.ehe.osu.edu/issue/water-ice-and-snow/common-misconceptions-about-states-and-changes-of-matter-and-the-water-cycle>

NGSS Lead States. (2013). Next Generation Science Standards: For States, By States. 2-PS1

Matter and Its Interactions. Retrieved from <https://www.nextgenscience.org/>

Riley, C. (2014). *Science misconceptions*. Mr. Riley's Science.

<https://rileysci.com/science-misconceptions/>

Victoria State Government. (2018). *Problems with classifying solids, liquids and gases*.

Department of Education and Training Victoria.

<https://www.education.vic.gov.au/school/teachers/teachingresources/discipline/science/continuum/Pages/classifying.aspx>