



Messy Matter Teacher Guide

OBJECTIVE

To explore states of matter and to learn how to classify matter by its observable properties.

CONCEPTS COVERED

- Molecules make up matter.
- Molecules in a solid are held tightly together and don't move easily.
- The molecules in a liquid are looser and can move about easily.
- The molecules in a gas are more spread and move faster than the liquid molecules.
- Oobleck is a non-newtonian fluid that acts as a liquid or solid based on force.

SCIENCE PRACTICES

- Asking questions.
- Developing and using models.
- Planning and carrying out investigations.

STANDARDS ADDRESSED

- P-PS1-1. Ask questions and use observations to test the claim that different kinds of matter exist as either solid or liquid.
- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

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How to Use This Guide

This video is an introduction to matter; defining concepts like matter and chemical reaction. Your students will watch the *Messy Matter* video and will have access to a student guide that accompanies the video. The student guide includes a materials list and a procedure list to help them to recreate the experiment and to follow along with the experiment. The materials are all simple items they can find in their homes. If your students are not able to gather the materials to follow along with the experiment they can observe the Instructor conducting the experiment and its results. They will still be able to answer the reflection questions which are located at the end of the student guide. We have included those questions in the teacher guide with the answers. There are vocabulary words in the guide which students can refer to when any new concepts have been introduced. At the end of the teacher guide there are some links to other related NYSCI resources to extend the learning. We hope this video and guide can add some enrichment to your *Messy Matter* exploration.

Video Synopsis

In this video, students will explore the properties of matter. The four experiments allow students to use their senses to make observations about the different states of matter.

Activity 1 illustrates the concept that molecules are arranged differently in a solid, liquid and gas. Students will get the opportunity to make a prediction of how those molecules are arranged but making a model using cheerios.

Activity 2 enables students to see how liquids will take the shape of any container they are poured into and how solids such as the plastic bricks will not.

Activity 3 allows students to see a "gas." The resulting CO₂ from the chemical reaction of mixing an acid and base is captured in a balloon.

Activity 4 will push students thinking by having them interact with a substance that is both a liquid and a solid.

To get the most out of any science activity, students should be encouraged to follow their inquiries, further investigate, and create their own experiments. They can try the activities with different materials or different methodology and compare results, as well as use this video as a launching point to create their own matter experiments based on the additional questions that arise for them.

Background information

Activity 1: Matter as Molecules Molecules make up matter, it's anything that has mass and takes up space. The chair you're sitting on is a solid, the water you drink is a liquid, and the air you breathe is a gas. Molecules don't change but the way they move does. Matter changes state when more energy gets added to it. Energy is often added in the

form of heat or pressure. The molecules in a solid are held tightly together and don't move easily. The molecules in a liquid are looser and can move about easily. The molecules in a gas are more spread and move faster than the liquid molecules.

Activity 2: Liquids Liquids take on whatever shape the container is. Solids have a definite shape and don't take the shape of their container.

Activity 3: Gassy Balloon Gas just refers to a form of matter where the molecules are really spread out. A gas fills the space it's in — its molecules spread out as far as they can until they take up the whole space. The air we breathe is a gas, so is the steam we see coming off a pot of boiling water. When acid and a base meet there is always a reaction. In this case they start to make carbon dioxide gas. Carbon dioxide is a gas that we actually make in our own bodies, it's present in every breath we exhale. It is odorless, colorless, and hard to sense without additional help. But it does take up physical space, as we can clearly see and feel! The carbon dioxide gas molecules are spreading out as far as the balloon allows, trying to fill the whole space of the container. If I were to remove the balloon the molecules would begin to spread out in this room, until they are fully mixed in with the air in this room.

Activity 4: Oobleck Oobleck is a non-Newtonian fluid. A non-newtonian fluid acts as a liquid or solid based on force. Notice when you apply force by squishing it, it feels more like a solid, but when you let it rest on your hands, it runs like liquid.

ACTIVITY TIPS

Troubleshooting tips for the activity

- Wear an apron or old t-shirt you don't mind getting messy.
- Feel free to do any or all of these activities on a tray or line your table with plastic table cloth and have paper towels nearby.

Activity 1: Matter as Molecules

- Make sure the objects you're using to represent the molecules are similar in size.

Activity 2: Liquids

- Make sure the amount of liquid you use is less than the amount that can fit in your smallest container.
- For the solids you select to use, try to make sure that they are similar in shape and size such as wooden blocks or plastic bricks. The larger your solid object, the more obvious the concept of solids not taking the shape of their container is.

Activity 3: Gassy Balloon

- Roll up a piece of paper and tape it to create a paper funnel, make sure that you keep the opening as large as the opening of the balloon. The paper funnel will make it much easier to fill the balloons with baking soda.
- The more vinegar you add, the bigger the reaction will be. If you are doing this experiment in a place where mess would not be welcomed consider adding just a little at first. If the result isn't as exciting as you hoped, you can always re-do the experiment and use more vinegar!

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Check out more activities
at www.nysci.org.

Activity 4: Oobleck

- If you are adding food coloring to your oobleck, make sure to add the food coloring to the water first and mix well before adding it to the cornstarch. This will limit the amount of food coloring that will stain your hands.
- Add the water to your cornstarch slowly.
- If the mixture is too runny add a teaspoon of cornstarch. If the mixture is too cakey, add a teaspoon of water.
- Once you finish the experiment, you can put away your oobleck in a resealable container or a plastic baggie. If you don't want to keep your oobleck, I would wait until it dries a bit and throw the dried cornstarch out in the garbage instead of down the sink.

Questions and Answers (Student Guide)

Can matter exist as two phases?

Yes, oobleck is a great example of this. It is a non-newtonian fluid that acts as a liquid or solid based on force. Notice when you apply force by squishing it, it feels more like a solid, but when you let it rest on your hands, it runs like liquid.

How did you arrange your cheerios differently for a solid than you did for a liquid or a gas?

Solids molecules should be placed as close together as possible. Liquids are slightly further apart and gas molecules are really spread out.

What do you think will happen if we put the oobleck in the freezer?

Oobleck in a freezer will become more of a solid just like ice but once it defrosts, it will become that non-newtonian fluid again.

Try These Next

Explainer TV

Maker Faire Oobleck Pool: youtube.com/watch?v=J5xtFLSKJXo

Ice Cream Making: youtube.com/watch?v=qxtUgQbEZjA

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