

FOR TEACHERS

MAKER LESSON PLAN: The Science of Slime Investigation

Essential Questions:

- What is matter?
- What are the physical states of matter and their properties?
- What are Newtonian and non-Newtonian fluid?

Lesson Objectives:

Students will:

- Explore different states of matter and their properties
- Make a scientific hypothesis about the physical state of slime based on their prior experiences with slime
- Investigate and define the properties of slime and other non-Newtonian fluids

Materials/Resources:

- Slime Instructable:
<https://www.instructables.com/id/How-to-Make-Slime-Without-Borax/>
- Slime creation materials and ingredients (See Instructable)
- Teacher Information Sheet (Page 2 of Lesson Plan)
- Student Science of Slime Investigation Sheet (Pages 3-4)

Video Resources:

- <https://www.youtube.com/watch?v=ELchwUIIWa8>
- <https://www.youtube.com/watch?v=Fnd-2jetT1w>

Overview: In this lesson, students will investigate the properties of matter and non-Newtonian fluids. Using the slime Instructables and data sheet linked above, students will make a hypothesis about slime, create their own slime mixture, and record their observations throughout the process. At the end of this investigation, students should be able to explain the different states of matter and their properties, how matter changes, the properties of Newtonian and non-Newtonian fluids, and whether or not their original hypothesis of the physical state of slime was correct. ***Before launching this activity with students, take time to review the Slime Instructable and Lesson Materials/Resources, gather the resources needed for the investigation, and prep your classroom space for slime creation.**

1: Introduce the Science Investigation - Explain to students that they are going to do a science investigation to explore matter, the different states of matter, and the unique properties of different types of matter. **Begin** by starting a class discussion to explore the topic by asking students if they can list the 3 main states of matter and record their responses on the board or DocCam. **Ask students** to name some of the properties that can help them determine when something is a solid, liquid, or gas and continue recording responses to make lists next to each main state of matter. **Discuss** their responses and fill in any properties that were missed. [Example: Solid - hard, holds shape without a container | Liquid - molds to the shape of any container, maintains constant volume, non-compressible | Gas - compressible, expands to fill a container (i.e. balloons)] **Further the discussion** and add real-world examples to the visual list by pointing out objects in the classroom and asking student to determine if it is matter and what state it is in. (Don't forget to mention the air everyone is breathing.)

2: Building Physical Science Knowledge - To reinforce student understanding of the concepts covered during the class discussion, explore matter with students using the Crash Course Kids "What's Matter?" video in the resources listed above or your own favorites.

3: Investigating Matter/Creating Slime - Explain to students that as part of this Science Investigation into matter they will be combining different substances to create slime and they will have to identify its properties to determine what state it is in. (This may be a good time to remind students of the classroom procedures for STEM projects and/or Science Investigations.) Pass out the Science of Slime Student Investigation sheet. Have students fill out the table on front page of the sheet and write their hypothesis about the state of slime while setting up materials for slime creation. Go over the Slime Instructable Procedures with students and create slime. Once students have made their slime, allow a few minutes of exploration and recording of the properties they notice on page 2 of the investigation sheet before having them bag up their creation to take home.

4: Share - Have students share their findings and their hypothesis about the state of slime. Then introduce Newtonian and non-Newtonian Fluids, using the second video listed above or by sharing the definitions, properties, and some real-world examples. Ask students think about their slime and everything they learned through this investigation to make a final determination of the state of their slime and whether their hypothesis was correct.

Don't forget to take pictures of all the awesome slime creations and share them with us as an "I Made It" on the Instructable, via email at teachers@instructables.com, or on Twitter and Instagram @instructables. We would love to send your class a gift for showing off their hard work!

FOR TEACHERS

Teacher Information Guide: The Science of Slime Investigation

Concepts:

This lesson covers the different states of matter including non-Newtonian Liquids. Through this lesson students will explore the properties of matter and real-world examples of different types of matter. Students will then create slime and use their knowledge and experiences to determine the physical state of slime.

Vocabulary to explore with students:

- **Hypothesis** - A hypothesis is a prediction about what we think will happen in an experiment.
 - Example: IF an object is cut into smaller pieces, THEN the physical properties of the object and its smaller pieces will remain the same)
- **Matter** - Matter is anything that takes up space and has mass (weight).
- **3 Main States of Matter** - Solid, Liquid, Gas
- **Physical Properties** - Characteristics that an object has that we can determine using our 5 senses.
 - Example: Color, Softness/Hardness, Texture, Magnetism, density, solubility)
- **Viscosity** - the property of a liquid that describes how fast or slow it will flow; generally the thicker the liquid, the slower and more viscous it is.
- **Newtonian Fluids and Non-Newtonian Fluids** - are determined by the rate at which the fluid flows. Newtonian fluids (or normal fluids) flow at a consistent rate. Non-Newtonian fluids (or non normal) fluids flow at a different rate depending on how much force or pressure is applied to them.

Example Discussion Chart for the Board or DocCam:

State of Matter	Physical Properties	Real-World Examples
Solid - a form of matter that has a definite shape and volume	Hard, holds its own shape without a container, breakable or rips/tears	Ice, metal, desks, pencils, doors, wood, bricks, gold, paper, folders, sand, mulch, plastic
Liquid - a form of matter that has a definite volume but no defined shape	Flows, Non-compressible, molds to the shape of its container, maintains constant volume, evaporates, spills	water, juice, milk, coffee, rain
Gas - a form of matter that does not have a defined shape or volume	Compressible, expands to fill its container (may need to demonstrate this with a balloon)	air, propane, helium, steam

Add Non-Newtonian Fluid to the chart after students finish creating and exploring their slime:

Non-Newtonian Fluid	Viscosity changes with increased or decreased pressure (hardens or softens), non-compressible	ketchup, quicksand, honey, paint, toothpaste, oobleck
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Name: _____

Student Data Sheet

Date: _____

What is matter?

Build your Scientific Knowledge by completing this chart:

State of Matter	Physical Properties	Real-World Examples
Solid		
Liquid		
Gas		

Hypothesis:

Name: _____

Student Data Sheet

Date: _____

Use your Scientific Knowledge and 5 Senses to examine your slime and record your findings:

Type of Matter	Physical Properties	Other Real-World Things That Have Similar Properties
Slime		

What is a non-Newtonian Fluid?

Type of Matter	Physical Properties	Real-World Examples
Non-Newtonian Fluid		

Conclusion:

Think about your Hypothesis and everything you have learned during this Science Investigation, then explain whether slime is a solid, liquid, or gas and how you know based on its physical properties.
