Is Oobleck a solid or a liquid?

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Grade: Kindergarten Science

Lesson Duration: 70 minutes

Standards:

- **K.PS1.1 Matter and Its Interactions** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties and whether they are natural or human-made
- **K.PS1.2 Matter and Its Interactions** Conduct investigations to understand that matter can exist in different states (solid and liquid) and has properties that can be observed and tested.

Lesson Objectives:

The learner will:
- construct a hypothesis
- observe experiment
- analyze data
- report results
- distinguish between the properties of solids and liquids

Central Focus:

This lesson will emphasize higher thinking, collaborative learning and discussion regarding the Scientific Method as well as understanding the properties of matter, specifically solids and liquids, while introducing a new substance that behaves as both.

Materials:
- cornstarch
- water
- food coloring
- measuring cup
- bowl
- spoon
- art smocks
- tablecloths
- pie tins
- trays
- sticky notes
- chart paper
- science journals or standard paper
- Optional, copy of Bartholomew and the Oobleck, by Dr. Seuss

Recipe for Oobleck: 1 cup of cornstarch, add water slowly, until the mixture is thick while stirring, and stir in a couple of drops of food coloring. (Usually around 1 cup of water or slightly less will be added)

Background Information:

Matter is everywhere and can be categorized into three different categories: solid, liquid or gas. The Scientific Method is composed of various steps to test and prove ideas. These steps include: make an observation, form a question, conduct an experiment, analyze data, draw a conclusion. In this lesson, students will use the scientific method to investigate Non-Newtonian fluids, which act as a solid and a liquid depending on the force being applied to them. Examples include: toothpaste, blood, and shampoo. In the book, Bartholomew and the Oobleck, by Dr. Seuss, the king asks his magicians to create a new substance which threatens to ruin the whole town.

Instruction:

Introduction

Teacher Says: "Today we are going to do a whole group experiment to help us learn more about matter and its properties — specifically solids and liquids."

Ask students to show a thumbs up/thumbs down to indicate if they remember the steps of the Scientific Method. Ask them to share at their tables any part(s) they remember. Review the process together before moving forward.

Teacher Says: "We will use what we learned last week about the scientific method to help us construct a hypothesis, or create a question, as well as analyze our results, and draw a conclusion today. What are some other experiments we have done this year? Why do we do experiments? Why is it important to know how to conduct experiments?"

Whole Group

Gather students to view the experiment while demonstrating combining cornstarch, water, and food coloring. Before beginning, ask students to form a hypothesis regarding what might happen when the water and cornstarch combine. Have students share their idea with someone next to them. Ask several to share their hypothesis. Students will observe, examine, and then verbalize changes in the materials as they are combined. As these changes occur, students will analyze the data and check to see if their hypothesis was correct, and determine whether the mixture is a solid, a liquid, both, or neither.

Relate this experiment with the previous reading of Bartholomew and the Oobleck. Quickly review the beginning, middle, and end of the story, as well as discuss the problem and solution. Explain the substance the magicians made in the story can be made by using science.

Activity

Students will have a chance to explore Oobleck for themselves in small groups to determine if it is a solid or a liquid.

While working in small Groups, students will:

- verbalize how they experience the mixture
- answer teacher questions
- determine if Oobleck is a solid or a liquid
- verbally justify their answer

New Vocabulary

Introduce the term Non-Newtonian fluid. Define as a fluid that has properties of solids as well as liquids depending on the amount of force applied to it.

Ask students if they can think of another example of something else that might be like Oobleck and considered a Non-Newtonian fluid.
Examples include: ketchup, toothpaste, shampoo, paint and blood.

Tell students that there is a living animal that can behave as a Non-Newtonian fluid. Have them brainstorm for 30 seconds to guess what it could be, then discuss with a neighbor.

Technology Connection

1. Share the following clips on youtube.com from the New York times, The Incredible Physics of Ants: https://www.youtube.com/watch?v=opHsaJ1hxuc and/or *Mass of ants behaving as a fluid* on youtube.com

2. After viewing, teacher asks, "How could studying ant behavior be helpful scientists as they engineer new products?"

Differentiation

Students will write about their experiences with the mixture. To differentiate, the type of written response students will complete depends on the student's proficiency level (approaching grade level, at grade level, or above grade level):

- Approaching grade level students will respond in writing with a picture, adjectives and one sentence about Oobleck
- At grade level students will respond in writing to recall their hypothesis/prediction and their discoveries with prompts (Oobleck feels, smell, looks, acts) and to draw a picture
- Above grade level students will describe in writing, while using complete sentences, their results to various tests they performed of the Oobleck, such as (poking, pouring, squeezing, etc). Students will also add a quick picture of the way the mixture responded to various tests.

Closure

Ask students to think about what they learned today to turn to a neighbor to share one thing they learned. Invite several students to share verbally with the group.
Give each child a sticky note. Ask them to think of an example of a liquid OR a solid, then write the name of the example on the sticky note. Have students place their response on the chart under the heading of Solid or Liquid.

Assessment

During this lesson, assess understanding and learning throughout by questioning students and observing their ability to employ the scientific method, and collaborate in small groups. At the end of the lesson, assess learning by asking students to individually write an example of either a solid of a liquid on a sticky note and placing it on a chart that sorts the examples into two categories. Students will also summarize their experience with this experiment in written form which requires them to recall observations and demonstrate understanding.

Follow Up/Extension

Students will be given an opportunity to independently interact with the Oobleck mixture to predict if specific items will float or sink, then test each prediction, and record the data results in a science journal. Students will determine why some items floated and others sank and record a supporting sentence.

Items to test:

- paper clip
- penny
- marble
- toothpick