Non-Newtonian Fluids - How Slow Can You Go?

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Subject: Science

Grade Level: Upper Elementary

Standards:

Next Generation Science Standards (www.nextgenscience.org)

5-PS1-3 Make observations and measurements to identify materials based on their properties.

Schedule:

CCMR Lending Library Connected Activities:

- Getting Silly with Putty
- Glued into Science

Objectives: Students will be able to collect data from their samples, graph the data using an appropriate scale, and analyze the results.	**Vocabulary:** Direct Proportion Newtonian Fluid Non-Newtonian Fluid Viscosity
Students Will: ● Make different varieties of silly putty as their samples. ● Measure how far the silly putty has dripped down the wall/window with respect to time. ● Graph the data they collected. ● Identify the type of relationship (direct, inverse, or neither) based on the graph. ● Explain what a point represents on the graph in terms of the situation.	**Materials:** ● Liquid Glue ● Borax ● Corn Starch ● Water ● Food coloring ● Dixie cups ● Craft stick or spoon ● Eye Dropper ● Activity Sheet ● Expo Marker ● Ruler or Meter Sticks ● Food Coloring
Safety	This activity does not contain any safety concerns. All materials can be disposed of in the trash

Science Content for the Teacher:

To learn about non-Newtonian Fluids and the science behind them, visit:

Rohrig, B. (2004, December). The Science of Slime. *Chem Matters*, 13-16. https://www.acs.org/content/dam/acsorg/education/resources/highschool/chemmatters/articlesbytopic/solidsliquidsgases/chemmatters-dec2004-slime.pdf

Preparation:

1. Copies of Activity Sheet for each student
2. Copies of Silly Putty Instructions (about 1-5 each, depending on size of class).
3. Create sodium tetraborate (Borax Solution) by mixing Borax and water (1 tablespoon of dry Borax per 1 cup of water).
4. Separate the rulers, expo markers, craft sticks, and dixie cups into group sets so each group has one of each.
    a. The teacher can create the different versions of the silly putty to hand out to the groups instead.


b. Groups can do multiple samples. In this case, have enough supplies per group for them to do multiple samples.

5. If you want to watch the video with the class, have speakers and a projector prepared. https://www.youtube.com/watch?v=vcmMHQMSzBY

Classroom Procedure:

Before class, see Preparation above.

- Assign student roles in the group. Steps 1 through 7 are taken from the Activity Sheet.

1. Choose one version of Non-Newtonian fluid that you will test. Write that version on the line. _____

A.	B.	C.
Glue Borax Solution	Glue Borax Solution Water	Water Corn Starch

2. The measurer will measure how far the silly putty has fallen from its original spot on a vertical surface at 30 seconds, 1 minute, 3 minutes, 5 minutes and 3 additional times decided by your group. These times must be less than 10 minutes long. Write your three times in the boxes below.

3. Order your times from smallest to greatest in the table on the next page.

4. Create your version of the non-Newtonian liquid.

5. Place non-Newtonian liquid on a vertical surface (window, white board, chalk board) by holding the it against the surface for 10 seconds. BEFORE LETTING GO of the non-Newtonian liquid, MARK where the bottom of the non-Newtonian liquid is with a marker (make sure the line is wide enough that you can see it even after the silly putty drips over it). Once the handler let's go of the non-Newtonian

liquid, the Timer starts the timer.

6. Measure the distance the non-Newtonian liquid has fallen from its starting point using a ruler at each designated time and record your results in the table.
7. Once you are done, throw out the non-Newtonian liquid, along with the cup, mixing stick, and any excess materials used to make the non-Newtonian liquid
8. Once all of the groups are done, have students share their results. Students will then compare the results to answer the analysis questions.

Assessment:

Collect the lab packets to analyze students' mastery. Teachers can grade one per lab group if they want. The most important questions to look at are the graph (based on the table), and questions 1 and 7 from the analysis.

Resources:

Science Activity: Is This Stuff a Liquid Or a Solid? | Exploratorium. (1998). Retrieved from https://www.exploratorium.edu/science_explorer/ooze.html

Rohrig, B. (2004, December). The Science of Slime. *Chem Matters*, 13-16. https://www.acs.org/content/dam/acsorg/education/resources/highschool/chemmatters/articlesbytopic/solidsliquidsgases/chemmatters-dec2004-slime.pdf

Extra Activities:

1. Students can do research on non-Newtonian fluids and where they are used in the real world.
2. Test other properties of non-Newtonian fluids

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