# Creepy Behavior

**Grades:** 9-12
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**Source:** Adapted from Akron Global Polymer Academy
http://www.agpa.uakron.edu/p16/lesson.php?id=creepy&pg=abstract

Begin by introducing the concept of "creep" and ask the students, "do mountains move?" and if they do "how fast do mountains move?" Be sure to ask them why mountains move as well. Then discuss how different materials flow at different rates based on their chemical composition, formulation and due to the forces they are subjected to. Draw the structure of starch on the board and ask the students what time of intermolecular interactions a water cornstarch mixture would have (hydrogen bonds). Then discuss the unique rheology of cornstarch water mixtures. Ask the students to form a hypothesis of the flow rate of the cornstarch water glop as the height of the ramp is increased. Ask them to back up their hypothesis with scientific reasoning. It's okay if it's not right!

Preparation of Creepy Material

The instructor should prepare a master batch of a glop consisting of cornstarch and water for the whole class to use. Cornstarch should be added to a large amount of water in a container until the desired consistency is achieved. A wooden stick or spatula can be used for mixing. The glop should be just *a little* runny so that students can actually achieve measurements over the time scale of the experiment.

Other Materials:

- Clipboard or any material that can serve as a flat ramp
- Small beaker
- Masking tape
- Books or blocks
- Ruler (can print out a ruler on regular paper and place it inside a transparency sleeve)

## Creep Experiment Procedure

1. Set up the equipment exactly as it appears in the Figure 1. Specify 3 heights - determined by what is used to elevate the clipboard. Use the tape to hold the beaker in the correct location. **The creeping material must flow down the metric scale on the ruler.**

**Figure 1: Set up for Creep Experiment**

2. Turn the clipboard so the beaker is upright. Add creeping material to the beaker. Cover the beaker to hold the creeping material in when replacing the clipboard on the prop.
3. Uncover the beaker and start the stop watch when the creeping material flows across the 0 cm line on the ruler.

4. While the creeping material is moving down the board, take readings every half minute for a maximum of 10 minutes.
5. Read, to the nearest tenth of a centimeter, the location of the front of the creeping material on the metric scale. Record your observations on the data table.
6. After completing the readings, remove the clipboard and set it so the beaker is upright. Peel the creeping material from the plastic sheet, return it to the beaker, and cover the beaker.
7. Adjust the clipboard to the next height. Repeat procedures.

## Student Answer Sheet

1. Predict what will happen to the flow of glop as the clipboard is elevated. Explain your reasons why.

2. Use the data table to record your observations to the nearest tenth of a centimeter per half minute.

| Time (minutes) | Trial 1 _____Distances (in centimeters) | Trial 2 _____Distance (in centimeters) | Trial 3 _____Distance (in centimeters) |
|---|---|---|---|
| 0 | | | |
| 0.5 | | | |
| 1 | | | |
| 1.5 | | | |
| 2 | | | |
| 2.5 | | | |
| 3 | | | |
| 3.5 | | | |
| 4 | | | |
| 4.5 | | | |
| 5 | | | |
| 5.5 | | | |
| 6 | | | |
| 6.5 | | | |
| 7 | | | |
| 7.5 | | | |
| 8 | | | |
| 8.5 | | | |
| 9 | | | |
| 9.5 | | | |
| 10 | | | |

3. **Make a graph on the computer using Microsoft Excel®.** Enter time as your x-axis and distance as your y-axis.
4. You will create a **line graph** with **time** as your **x variable** and **distance** as your **y variable**.
5. Once you have created the graph find the "best fit line" and the corresponding slope. The slope is the rate of movement of the glop.

6. Which height shows the greatest slope and why?

7. Is the rate of movement constant over the whole time period of testing or does it change?