



Classroom Teacher Preparation

Chemistry 3: Polymer Investigation

Please use the following to prepare for the next SfS lesson.

Description:

Students create cross-linked polymers and investigate their polymer's behavior. Younger students (3rd-5th) will use pre-made solutions (e.g., with cornstarch) to make different polymers within a group of 4. They will then ask and answer a testable question to compare their group's four polymers, e.g., which one bounces the highest. Older students (6th-8th) will attempt to make a polymer that will stretch the longest without breaking by varying the amount of water and borax solution used. Students in all grades will have the opportunity to present their results to the class.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

3rd-8th

- (3rd-5th) Analyze how variables affect the behavior of a polymer
- (6th-8th) Design an experiment, using variables, to create a slime that meets predetermined specifications

Disciplinary Core Idea (DCI)

PS1 Matter and its Interactions - PS1.A Structure of Matter

- (3rd-5th) Because matter exists as particles that are too small to see, matter is always conserved even if it seems to disappear. Measurements of a variety of observable properties can be used to identify particular materials.
- (6th-8th) The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter, phase changes, and conservation of matter.

Science & Engineering Practice (SEP)

Asking Questions and Defining Problems

- (3rd-5th) Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships

Planning and Carrying Out Investigations

- (6th-8th) Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.

Crosscutting Concept (CCC)

Structure and Function

- (3rd-5th) Different materials have different substructures, which can sometimes be observed.
- (6th-8th) Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.

Preparation:

No preparation is necessary for this lesson.



Room Set Up for Activities:

Students will work in groups of 4 at their desks or tables.

Safety:

Students will work with a solution of borax powder. Pipettes will be used to transfer the solution and mixing will occur in sealed plastic bags.

Students should be mindful of good safety practices as reviewed by the instructors.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on Chemistry. Modules include:

Chemistry 11: States of Matter – Students will learn about the three commonly observed states of matter (solid, liquid, gas) and observe many of the transitions between the different states using dry ice. For older students, this topic is connected to heat transfer and the flow of energy.

Chemistry 14: Viscosity – Students work in groups to examine the viscosity of five liquids (honey, shampoo, corn syrup, pancake syrup, and olive oil) using falling sphere viscometers

For other module sequences and groups, look here: www.sciencefromscientists.org/sequences

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state:

www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by creating a polymer that bounces higher than 10cm when dropped from 30cm.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- Experiment with a magnetic polymer <https://www.stevespanglerscience.com/lab/experiments/magnetic-slime/>
- Experiment with a polymer you chew! <http://polymerambassadors.org/pdf/chewinggum.pdf>