# The Next Generation Science Standards

There is no doubt that science—and, therefore, science education—is central to the lives of all Americans. Never before has our world been so complex and science knowledge so critical to making sense of it all. When comprehending current events, choosing and using technology, or making informed decisions about one's healthcare, science understanding is key. Science is also at the heart of the United States' ability to continue to innovate, lead, and create the jobs of the future. All students—whether they become technicians in a hospital, workers in a high tech manufacturing facility, or Ph.D. researchers—must have a solid K–12 science education.

Through a collaborative, state-led process, new K–12 science standards have been developed that are rich in content and practice and arranged in a coherent manner across disciplines and grades to provide all students an internationally benchmarked science education. The Next Generation Science Standards are based on the *Framework for K–12 Science Education*

https://www.nextgenscience.org/get-to-know

*A few details about the Next Generation Science Standards*

- Every NGSS standard has three dimensions: disciplinary core ideas (content), scientific and engineering practices, and cross-cutting concepts.
- Scientific and Engineering Practices and Crosscutting Concepts are designed to be taught in context – not in a vacuum. The NGSS encourage integration with multiple core concepts throughout each year.
- The NGSS are standards, or goals, that reflect what a student should know and be able to do— they do not dictate the manner or methods by which the standards are taught.

The performance expectations are written in a way that expresses the concept and skills to be performed but still leaves curricular and instructional decisions to states, districts, school and teachers. The performance expectations do not dictate curriculum; rather, they are coherently developed to allow flexibility in the instruction of the standards. Thus, you will need to work closely with your classroom teacher(s) to choose important lessons that assist the teacher in meeting his/her educational goals.

**The lesson ideas found below are merely suggestions of experiments that can be taught in a particular grade or unit of study. RESET will work closely with you, the volunteer, and the classroom teacher to choose experiments and determine the best ways to present.**

# Next Generation Science Standards (K-5) listed with experiments that may help teach the standard

*PS – Physical Science; LS – Life Science;*
*ESS –Earth & Space Systems; ETS – Engineering Design, Technology and Application Science*

## 5-PS1-1 Matter and Its Interactions

Develop a model to describe that matter is made of particles too small to be seen.

## 5-PS1-2 Matter and Its Interactions

Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

## 5-PS1-3 Matter and Its Interactions

Make observations and measurements to identify materials based on their properties.

**TITLE.** Polymers are LONG

**SUBJECT:** Chemistry

**OBJECTIVE**: Identify a polymer based on its characteristics

**SUMMARY**: Polymers are materials made of long, repeating chains of molecules. The materials have unique properties, depending on the type of molecules being bonded and how they are bonded. Some polymers bend and stretch, like rubber and polyester. Others are hard and tough, like epoxies and glass.

Polymers touch almost every aspect of modern life. Chances are most of the students in your classroom will have been in contact with at least one polymer-containing product — from water bottles to gadgets to tires — in the last five minutes.

**GRADE LEVEL:** FIFITH

**VOCABULARY:**
Monomer
polymer

**SET UP:** Normal classroom orientation for Classroom demonstration that enhances class participation

**PROCEDURE:**

Step 1: Pour 4 ml of polyvinyl alcohol in Petri dish, add 4 ml of acetone.

Step 2: Demonstrate how to **draw** a polymer fiber by dipping the copper wire into the solution. Wire ought to be drawn slowly and continuously on a straight line upwards.

Step 3: "Draw" several fibers and measure longest length.
Step 4: Have teacher draw a fiber and measure it.
Step 5: Have a contest to see who can draw the longest fiber.

**MATERIALS:**

| Description | Quantity | Can be purchased at |
|---|---|---|
| Petri dish | 1/student | teacherscource.com |
| aqueous polyvinyl alcohol (4%)4 ml x # of students. | 4ml/student | *Amazon.com |

- https://www.amazon.com/3-8L-Polyvinyl-Alcohol-Aqueous-Solution/dp/B01BLNB53A

| | | |
|---|---|---|
| Acetone | 4 ml x # of students | *Amazon.com |

*https://www.amazon.com/Acetone-Grade-Curated-Chemical-Collection/dp/B07FTP6BDW/ref=sr_1_1?dchild=1&keywords=acetone&qid=1588181898&s=industrial&sr=1-1

copper wire: with loop on end measuring stick 6 inch/student
*Amazon.com

*https://www.amazon.com/Bare-Copper-Bright-Diameter-Length/dp/B000IJXXNE/ref=sr_1_3?crid=3U8Z9JO5B6Q2A&dchild=1&keywords=copper+wire&qid=1588181992&s=industrial&sprefix=copper+wi%2Cindustrial%2C140&sr=1-3

## 5-PS1-4 Matter and Its Interactions

Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

**TITLE:** GOO: Slimes and Polymers

**SUBJECT:** Chemistry

**OBJECTIVE:** Learn about Polymers

**SUMMARY:** A polymer is a substance formed from long chains of repeating units. The chains can be linked to each other. Polymers can be flexible, strong, and stretchy. Students will be able to make their own polymer…called Oobleck.

**GRADE:** Fifth

**VOCABULARY**: Polymer

**SET UP**: Desks pushed into groups of four and covered with newspaper

**PROCEDURE:**

STEP 1: Discuss the definition of a polymer. Explain to the students that today they will make their own polymer.

STEP 1: Cover the work area with newspaper. This is a messy project.
STEP 2: Measure out two parts cornstarch (decide in advance if you want to make enough for each table or each student). For example: 1 cup cornstarch to a ½ cup water.
STEP3: Pour cornstarch into a bowl
STEP 4: Use the measuring cup to now measure out the appropriate amount of water (2:1 ratio Cornstarch: Water) and slowly add water until the right consistency is created. This requires a trial and error process. Add the water slowly so the mixture does not get too wet.
STEP 5: Stir, pour, roll, and squeeze the ooblek. Have fun!
STEP 6: Once the students have had enough time to investigate, have them each wash their hands while volunteer rolls up the newspaper covering at each table with all ingredients inside –except measuring cups if they were used) and throw away.
STEP 7: Bring students back to the circle or their desks and ASK:

Do you think ooblek a liquid or a solid?
Which two substances did we mix together to make ooblek?
Is cornstarch a polymer?
Is ooblek a polymer?
ooblek is fluid made by suspending the **polymer** cornstarch in water. ... The shear-thickening, non-Newtonian behavior of cornstarch is a result of the separation of the **polymer** starch molecules in water.
Can you think of other substances that behave like ooblek?

**MATERIALS:**

| Description | Quantity | Can be Purchase |
|---|---|---|
| Measuring Cup | 1/table | Grocery store |
| *If $ is an issue, volunteer can pre-measure the cornstarch into bowls and a paper cup with water) | | |
| Water i | 1 | |
| Cornstarch | TBD | Grocery Store |

| | |
|---|---|
| Newspapers | Enough to cover each table |

## 5-PS2-1 Motion and Stability: Forces and Interactions

Support an argument that the gravitational force exerted by Earth on objects is directed down.

## 5-PS3-1 Energy

Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

## 5-LS1-1 From Molecules to Organisms: Structures and Processes

Support an argument that plants get the materials they need for growth chiefly from air and water.

## 5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

## 5-ESS1-1 Earth's Place in the Universe

Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.

## 5-ESS1-2 Earth's Place in the Universe

Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

## 5-ESS2-1 Earth's Systems

Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

## 5-ESS2-2 Earth's Systems

Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

## 5-ESS3-1 Earth and Human Activity

Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.