NAE4-HA Educational Piece Summary

Kasey Lynn Bozeman
Liberty County 4-H Agent
100 Main Street Suite 7130
Hinesville, GA 31313

Kasey Bozeman developed a 4-H SET – Polymer Playtime lesson for 5th-6th grade students. The lesson taught about states and properties of matter. Students created two types of polymers (gloop & slime) and completed simple data collection tests about each polymer. Students analyzed the data and compared/contrasted the gloop and slime.

NAE4-HA Educational Piece Abstract

Kasey Lynn Bozeman
Liberty County 4-H Agent
100 Main Street Suite 7130
Hinesville, GA 31313

Objectives: The headquarters of SNF, Inc., the world's largest water-soluble polymer manufacturer, is located in Liberty County. In an effort to teach about polymer science and connect students with local manufacturing, the applicant developed the "4-H SET: Polymer Playtime" educational piece. The 1.5-hour lesson aims at teaching students about states and properties of matter. The lesson includes an interactive PowerPoint presentation, where the educator teaches these science concepts (all aligned to the Georgia Common Core Performance Standards). After learning about polymers and their properties, students created two simple polymers – using cornstarch/water (gloop) and borax/liquid glue (slime). Students had to read polymer recipe instructions and demonstrate measuring skills. Once they made both polymers, students performed 9 scientific tests on each polymer, having to observe and collect data. Students analyzed the data by completing a Venn diagram, allowing them to compare and contrast each polymer. Reflection journal questions at the end of the lesson allowed student to generalize and apply the knowledge gained to their own lives.

Target Audience: The lesson was written for 5th and 6th grade students. The lesson was implemented at the Liberty County 4-H Cloverleaf County Council meeting.

Current Population: The Liberty County 4-H Agent and Program Assistant provide 38 monthly in-school 4-H club meetings to 698 youth in the 5th and 6th grade. These meetings are provided at 6 elementary schools, 1 middle school, and 1 private school.

Publisher's Requirement: The lesson plan was published and printed in-house; therefore, there were no publisher's requirements.

Production Methods: The lesson plan, polymer test descriptions, test data chart, and journal questions were typed using Microsoft Word. The Venn diagram and recipe cards were produced using Microsoft Publisher. The presentation was created using Microsoft PowerPoint. The vocabulary puzzle (cross-word puzzle) and word search were created using the Discover Education online website. The puzzles were then transferred to a Microsoft Word document. All files were saved as an Adobe PDF documents, to allow for easy sharing.

Production Costs: The lesson was published and printed in-house; therefore, there no specific printing costs incurred. To implement the lesson, supply costs include measuring cups, bowls, spoons, cornstarch, liquid glue, borax, and optional food coloring.

Impact Results: Eighteen youth attended the Cloverleaf County Council meeting where the lesson was facilitated. Additionally, the applicant shared the lesson plan and all materials with 2 other 4-H Agents in the state.

Applicant's Role in Entry: After finding various sources of credible information about the topic, the applicant solely developed the lesson plan using the Georgia 4-H Lesson Plan template. The applicant created the PowerPoint presentation based on the lesson plan content. The additional handouts (polymer recipes, polymer tests, data charts, Venn diagram, and journal questions) were also created by the applicant.

Georgia 4-H Lesson Plan: Polymer Playtime

BACKGROUND INFORMATION

Submitted By: Kasey Bozeman
County: Liberty
Contact Information: 912-876-2133; kaseyb@uga.edu

Grade Level: 5th - 6th
Subject: Physical Science
Estimated Time: 1 hour 30 minutes (may be condensed, as needed)

Lesson Description:
Students will learn about the characteristics of solids, liquids, gases, and polymers. Students will create 2 simple polymers. After conducting basic tests of these polymers, students will compare/contrast them.

OVERVIEW & PREPARATION

Standards:
The following Georgia Performance Standards (2007) are taught during this lesson:
ELA5R3/ELA6R2: The student understands and acquires new vocabulary and uses it correctly in reading and writing.
ELA5LSV1/ELA6LSV1: The student participates in student-to-teacher, student-to-student, and group verbal interactions.
S5CS1/S6CS1: Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.
S5CS3/S6CS4: Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities.
S5CS5/S6CS6: Students will communicate scientific ideas and activities clearly.
S6CS2: Students will use standard safety practices for all classroom laboratory and field investigations.

Georgia 4-H Core Values: Environment, Communication
Life Skills: Keep Records, Critical Thinking, Problem Serving, Learning to Learn

Objectives:
At the end of this lesson, the learner will be able to:

- Explain the difference between the terms matter, mass, and weight.
- Identify the basic characteristics of solids, liquids, gases, and polymers.
- Follow basic instructions to construct 2 simple polymers.
- Evaluate polymers by collecting data from characteristic tests.
- Relate the importance of polymers to their daily lives.

Materials:

- Polymer Playtime Prezi
- Computer, LCD projector, & screen for use of Polymer Playtime Prezi
- Printed copies of the following handouts:
    - Polymer Tests
    - Polymer Tests Data Chart
    - Recipes: #1 Gloop and #2 Slime
    - Venn Diagram
    - Polymer Playtime Word Search
    - Polymer Playtime Vocabulary Puzzle
    - Journal Questions
- Pencils
- Plastic bags that zip shut - sandwich size (2 per student)
- Labels
- Cornstarch
- White liquid glue or glue gel
- Borax
- Water
- Plastic bowls (cereal size)
- Metal spoons
- Measuring cups
- Food coloring (optional)
- Paper towels
- Tablecloth(s)
- Stopwatch
- Meter stick

Preparation:

- Review lesson plan and PowerPoint.
- Gather all materials.
- Arrange computer, LCD projector, and screen.
- Copy handouts for all participants.
- Cover all tables with tablecloths.
- You may want to have 1 table set-up with all the supplies needed to make both polymers. The other tables can be used as work stations. Students can come to this materials table in small groups to measure their ingredients for the polymers. The actual stirring and formation of the polymer can occur at their individual work station.

Vocabulary:

- Matter: anything that has mass and takes up space
- Mass: the amount of matter in an object; mass and weight are not the same measurement
- Weight: the measurement of the pull of gravity on an object

- Solid: matter with a definite size and shape
- Liquid: matter with a definite size (volume) but no definite shape
- Gas: matter without a definite size or shape
- Polymer: a chemical compound formed from long chains of the same molecule group
- Monomer: the individual units that are the building blocks that create polymers
- Natural: existing in nature or caused by nature
- Synthetic: not created by nature; something that is man-made
- Polymerization: the process of the smaller monomers bonding together to form the long polymer chain

LESSON PROCEDURE

Introduction:

Begin with a think-pair-share activity.

Ask students: Why is it important for you to understand the properties of items you use every day?

Allow students 1 minute to think of answers to this question. Pair the students together, and allow them 2 minutes to share their thoughts with their peers. If time permits, you can have a few peer groups share their thoughts with the group.

Tell students: It is important to understand the characteristics or properties of materials that compose items and objects. This allows us to better design items that can best meet our needs. In order for us to understand these properties, we first need to understand basic science concepts.

Development of Concepts/Core:

Ask students: What is matter?

Tell students: Matter is anything that has mass and takes up space.

Ask students: What is mass?

Tell students: Mass is the amount of matter in an object. Mass and weight are not the same measurement. Weight is the measurement of the pull of gravity on an object. The mass of an object does not change when an object changes location. Weight does change with location. If a ball weighs 5 pounds on Earth, its weight will be different on the moon because the moon's gradational pull is different than Earth's pull. However, the mass in both locations remains the same because the amount of matter making up the ball is the same in both locations.

Ask students: What are the three states of matter?

Tell students: Matter generally has three states or forms: solids, liquids, and gases.

Tell students: A solid is anything that holds a particular size and shape. Solids have a fixed volume and definite shape. An apple, a block of wood, and a button are all solids. The only way they can change their shape is by force. For example, you can bite the apple with your teeth or chop the block of wood with an ax. This is because the particles in a solid are tightly packed together. There is not much free space in between the particles, so there is very little room for the particles to move.

Tell students: A liquid is anything that has size or volume, but does not have a shape. Liquids must be contained in a cup, bottle, or other container in order to have a shape. Milk, water, and juice are liquids. When you pour milk into a glass, it takes the shape of the glass. If you spill the glass of milk on the floor, it will spread quickly as it takes the shape of the floor. If you pour the milk into a bottle, it will take the shape of the bottle, too. Liquid particles are not as close together as particles in a solid. They also move around and past each other much more freely. This allows them to be able to take the shape of their containers.

Tell students: Gases are hard to identify because they have no definite shape, mass, or volume. Take a deep breath and feel your lungs get bigger. Your lungs are filling up with air, and air is a combination of many gases. The particles in a gas move freely at high speeds. There is a lot of free space in between the particles, and they take the shape of any container they are given.

Ask students to complete a 3-2-1: Think of 3 examples of solids, 2 examples of liquids, and 1 example of gas. (Ask 2-3 students to share their examples with the class.) Students can also complete aloud the "name that polymer" quiz on the PowerPoint.

Tell students: Now, it is time to learn about polymers. A polymer is a chemical compound formed from long chains of the same molecule group. These chains repeat over and over. Monomers are the individual units that are the building blocks that create polymers.

Tell students: Polymers have unique characteristics. They are stretchable and flexible. They can bend easily. They are not brittle, hard, or rigid. Examples of polymers are plastics, silly putty, rubber, chewing gum, etc.

Ask students: Why do you think it is important make materials like car bumpers and trash bags out of polymers?

Tell students: Some polymers are made in the environment. This means that they are natural. Examples of natural polymers include rubber (made by rubber trees) and aloe (made by aloe plants).

Some polymers are also man-made. This means that they are synthetic. Examples of synthetic polymers are plastics such as trash bags, containers, machine and car parts, and construction hats.

Ask students: How do polymers form?

Tell students: Polymers form during polymerization. Polymerization is the process of the smaller monomers bonding together to form the long polymer chain.

Tell students: The next part of our lesson is to create 2 simple polymers and collect data about them. Before we begin, we must review the lab safety rules:

- Read directions carefully! If you are not sure what to do, ask for help.
- Do not smell directly from any container.
- Do not eat the gloop/slime or taste any substances used to make slime.
- Please do not put the gloop/slime where it does not belong … clothing, carpeting, or other people.
- Dispose of slime materials properly; do not put gloop/slime in the sink.
- Clean up messes immediately.

Tell students: Using the recipes provided, you will create 2 polymers: gloop and slime. Before you begin, label each plastic bag with:

Your name
Either #1 Gloop or #2 Slime

Using the provided materials, carefully create both of your polymers.

Note: The instructor may want to demonstrate proper measuring, mixing, and stirring techniques before the students begin the recipes. Instructors are highly encouraged to supervise all polymer making activities. If many students are present, you can allow a few to begin working on their polymers while other students complete the word search and vocabulary puzzle.

Once both polymers are created, students should begin testing each polymer using the different categories. All data results should be recorded in the data collection table. Students should complete all 9 test categories and then store their slime in their bags.

Test Categories:

- Description: What does the polymer look like? How would you describe its texture? What does it feel like?
- Smell Test: What does your polymer smell like? Remember not to directly smell the container. Waft the scent towards you.
- Sliminess Rating: How slimy is your polymer? Rate it from 1 = not very slimy to 10 = very slimy.
- Hang Test: Hold a glob of slime at a height of 1 meter above the table. Time how long it takes for the slime to reach the table. Write the time in your data chart.

- Roll Test: Try rolling the polymer into a ball shape. Roll the ball down the table. Measure the distance.
- Bounce Test: Roll your goop into a ball and drop from a height of 1 meter above the table. What happens?
- Poke Test: Roll the polymer into a ball. Poke your finger into it. What happens? How far does your finger go into the slime? What happens if you quickly poke it? Slowly poke it?
- Pull Test: Slowly pull on each end of the polymer. What happens? Does it change depending upon the speed of your pull (quick vs. slow)?
- Spread Test: Roll your polymer into a ball. Time how long it takes for it to spread or flatten out.

After interpreting their results, students should complete the Venn diagram worksheet, allowing them to compare and contrast the 2 polymers.

Ask students:

- Why is it important to study different types of polymers?
- Compare the gloop and the slime. How are they similar?
- Contrast the gloop and the slime. How are they different? What makes them different?

Wrap Up/Review/Reflection:

Students should clean up their work area. All slime should be stored in the individual plastic bags or put in the trash can. Students should complete the polymer word search and vocabulary jumble while waiting on other students to finish their procedures.

Ask students: Let us do a quick review to reinforce the concepts learned today:

- What is the difference between matter and mass?
- Name an example of each state of matter.
- What is a polymer?
- Name 2 characteristics of polymers.
- How do polymers form?
- Name a natural polymer.
- Name a synthetic polymer.

Tell students: Let us reflect upon today's lesson and apply it to your life. Complete the following journal questions.

- What did you do today?
- What did you learn today?
- How do you use polymers in your life?
- Why is it important to study science?
- How can you use the information you learned today?

Assessment:
During the polymer testing, students will collect data and record their measurements in a table. They will use this data to complete a Venn diagram comparing and contrasting the 2 polymers.

During the oral question review, students will share with their peers and the instructor the basic characteristics of solids, liquids, gases, and polymers. Students will reinforce new vocabulary terms by completing the vocabulary puzzle worksheet.

ADDITONAL INFORMATION

Useful Resources:

- Slime testing ideas were adapted from:

Trimpe, Tracy. "Science Classroom." *The Science Spot*. Web. <http://sciencespot.net/Pages/classchem.html>.

- Additional resources include:

"BrainPOP Jr. | Solids, Liquids, and Gases | Lesson Ideas." *BrainPOP Jr. - K-3 Educational Movies, Quizzes, Lessons, and More!* Web. <http://www.brainpopjr.com/science/matter/solidsliquidsandgases/grownups.weml>

"Polymer Activity - Fun Chemistry Lesson Plan, Science for Kids." *Science for Kids - Fun Experiments, Cool Facts, Online Games, Activities, Projects, Ideas, Technology*. Web. <http://www.sciencekids.co.nz/lessonplans/chemistry/polymers.html>.

Suggestions to Expand the Lesson:

- Ask a few students share their data collection tables with the class.
- Challenge students to create their own polymer test category. Test both polymers and collect the results.
- Students can share their Venn diagrams with the group, allowing for additional discussion of polymers.

Suggestions to Condense the Lesson*:*

- Ask students only to complete 3-4 polymer test categories instead of all 9 test categories.
- Orally discuss the application journal questions instead of having each student write down their individual answers.

Special Comments:
This lesson can get very messy very quickly. As the instructor, here are some teaching tips for you to follow:

- Be organized and label supplies, bags, etc.
- Ensure your students understand the safety rules.
- Try creating the slimes first. Make sure you understand the procedures before leading your students in the activities.

- If possible, allow time for you to demonstrate how to make the slime before the students create their own recipe. Modeling the expected behavior is a great teaching tip … especially when it comes to making messy polymers.

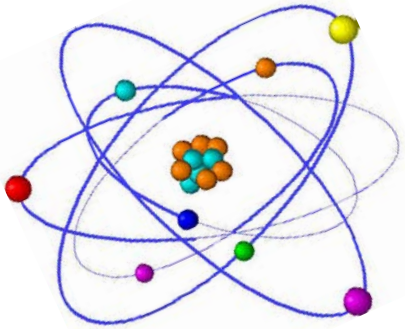
Recipe #1: Gloop

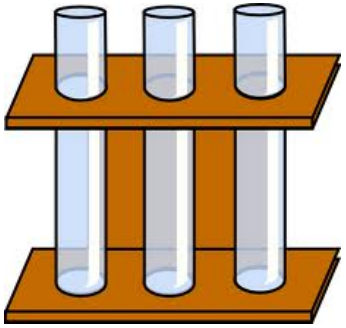
Materials:

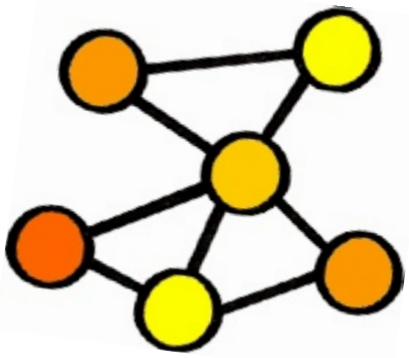
1/2 cup Cornstarch
1/4 cup Water
Measuring Cups
Bowl
Spoon
Plastic Bag
Food Coloring (optional)

Directions:

1. Measure cornstarch and water using measuring cups.
2. Pour both substances into bowl.
3. Mix using spoon.
4. Optional: add 1 drop of food coloring to dye the gloop.
5. Store gloop in plastic bag.



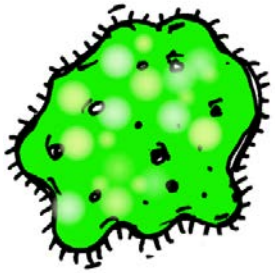




Recipe #3: Slime

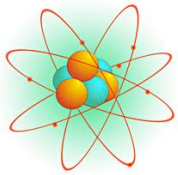
Materials:

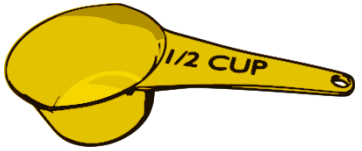
1/2 cup Warm Water
1/4 cup Borax
1/2 cup Glue or Gel Glue
Measuring Cups
Bowl
Spoon
Plastic Bag
Food Coloring (optional)



Directions:

1. Measure warm water, borax, and glue/gel glue using measuring cups.
2. Add the borax to the hot water. Stir until it dissolves.
3. Mix the borax water only (not the gritty bottom) & the glue/glue gel together.
4. Optional: add 1 drop of food coloring to dye the slime.
5. Store slime in plastic bag.





Polymer Tests

NOTE: If you are not able to do a test (slime too runny, plops, etc.), write a note in that space on your chart to explain why you were not able to do the test.

Description:
What does the polymer look like? How would you describe its texture? What does it feel like?

Smell Test:
What does your polymer smell like? Remember not to directly smell the container. Waft the scent towards you.

Sliminess Rating:
How slimy is your polymer? Rate it from 1 = not very slimy to 10 = very slimy.

Hang Test:
Hold a glob of slime at a height of 1 meter above the table. Time how long it takes for the slime to reach the table. Write the time in your data chart.

Roll Test:
Try rolling the polymer into a ball shape. Roll the ball down the table. Measure the distance.

Bounce Test:
Roll your goop into a ball and drop from a height of 1 meter above the table. What happens?

Poke Test:
Roll the polymer into a ball. Poke your finger into it. What happens? How far does your finger go into the slime? What happens if you quickly poke it? Slowly poke it?

Pull Test:
Slowly pull on each end of the polymer. What happens? Does it change depending upon the speed of your pull (quick vs. slow)?

Spread Test:
Roll your polymer into a ball. Time how long it takes for it to spread or flatten out.

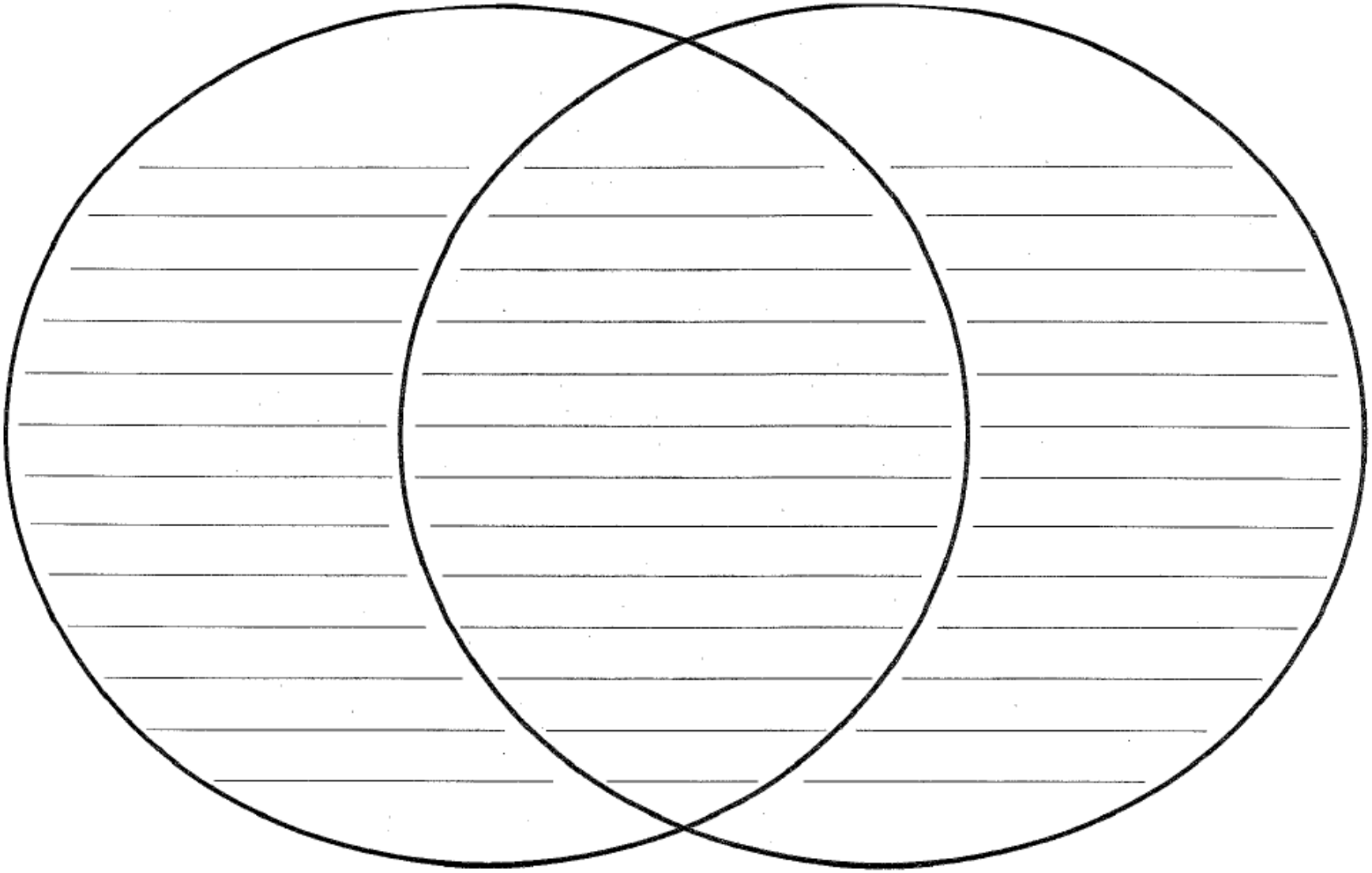
Polymer Tests Data Chart

Test Category	Polymer #1: Gloop	Polymer #2: Slime
Description		
Smell Test		
Sliminess Rating		
Hang Test		
Roll Test		
Bounce Test		
Poke Test		
Pull Test		
Spread Test		

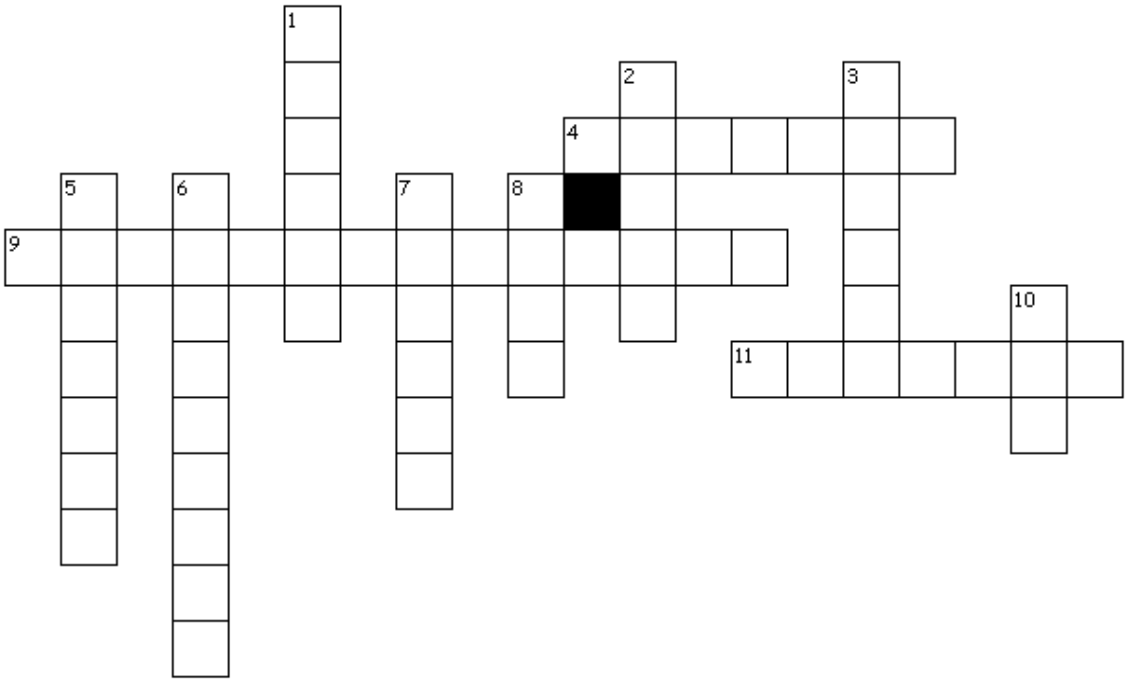
Polymer Playtime Venn Diagram

#1: Gloop

#2: Slime



Polymer Playtime Vocabulary Puzzle



Across

4. a chemical compound formed from long chains of the same molecule group
9. the process of the smaller monomers bonding together to form the long polymer chain
11. existing in nature or caused by nature

Down

1. anything that has mass and takes up space
2. matter with a definite size and shape
3. the measurement of the pull of gravity on an object
5. the individual units that are the building blocks that create polymers
6. not created by nature; something that is man-made
7. matter with a definite size (volume) but no definite shape
8. the amount of matter in an object; mass and weight are not the same measurement
10. matter without a definite size or shape

Polymer Playtime Word Search

P T S G N E I U W L R O D B R R U U C K
H O A M I K C F Q X V U R E W E B T U O
Z B L Z L B E N A L W Q M F H M E F K H
G W L Y X F Y V E Q M O E Q Y Y S I Z Z
N Q M T M W S A G I N Q Y M V L K S W R
O H I O C E N F R O C J R D Q O L Q V X
R Y K C T V R E M V U S W Z E P V Y A P
T H G I E W B I L A Y E L B I X E L F L
S Y I B R B D D Z N S J O H O T O Y A A
X F N F U E K I T A W S T E Y E A I X S
V O V R D Q L H U U T S O L I D W D Z T
O V E T U U E E Z Q J I N A T U R A L I
V Z S G Y T R F P K I E O J J E F V H C
V N T P I D C A N K M L X N V N L K J E
B D I C T M N R B N A R V B Q I Z D A J
S T G Y A L V Q A L J Z N E O H Z W W Q
G B A T G V V A N S E G Y N T M X G C V
U Y T E K D C I H P P N C D O D C X P O
E E E W P J X Q M H J K U R L Z F K W E
R F N Z N M E E A X G Z L J C G P K R N

Aloe
Bend
Durable
Flexible
Gas
Investigate
Liquid
Mass
Matter
Monomer
Natural
Plastic
Polymer
Polymerization
Rubber
Science
Solid
Strong
Synthetic
Weight

Polymer Journal Questions

What did you do today?

What did you learn today?

How do you use polymers in your life?

Why is it important to study science?

How can you use the information you learned today?