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| **Standard(s) addressed:** |
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| **MS-PS1-2.** | **Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.** |

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| **MS-ETS1-1.** | **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.** |
| **MS-ETS1-2.** | **Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.** |
| **MS-ETS1-3.** | **Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.** |
| **MS-ETS1-4.** | **Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.** |

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| **Targets:** (What will students know and be able to do as a result of this lesson?) |
| -**Experiment using the scientific method****-Discuss and use polymer terminology****-Participate in the engineering design cycle** |

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| **Assessment:** (How will you and your students know if they have successfully met the target?) |
|  **Students will be assessed throughout the seven days. The teacher will use observation and direct conversation to individually assess the abilities and understanding levels of each student. Students will complete a worksheet. An exit note may be provided by the teacher.** |

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| **Instructional Activities:** (In what learning experiences will students engage? Consider higher order thinking, multiple intelligences, multimodal, and/or multimedia input.) |
| Day 1-Unit IntroductionDiscuss #1-6 on note worksheetOptional: Oobleck - Make a batch and discuss the questions on the unit presentationDay 2-Gloop Make a batch and allow time to complete the slime testsDay 3-Boogers Make a batch and allow time to complete the slime testsDay 4-Goobers Make a batch and allow time to complete the slime testsDay 5-Super Slime Make a batch and allow time to complete the slime testsDay 6Complete puzzles and unfinished slime testsDay 7Mystery Slime Challenge -Provide students with samples of a mystery slime and challenge them to use the observations from their slime tests to identify what type of slime it isPreparationCorn Starch (Optional)-Place 1/2 cup of corn starch into ziploc bags and prepare enough bags for each pair of students in your class. Students will need to add water to create the right consistency. Have additional starch on hand in case they added too much water.Borax Solution for Gloop, Goobers, & Super SlimeMix 1 teaspoon (heaping) of borax powder for every cup of water. I mix the borax solution in a 1 gallon container (such as a bucket or milk jug) and usually need to make 2 batches to have enough for all the slimes. Pour the solutions into the small beakers for the students to use.Liquid StarchFill small plastic containers (such as old yogurt cups with lids) with liquid starch. You will need 1 container per group of 4 students. Have extra on hand to refill the containers as needed. NOTE: If you purchase a different brand than Stay Flo, be sure to make a test batch first! I've had some problems when using an off brand of liquid starch. Guar GumThe guar gum is a powder that comes in a plastic container and will keep very well from year to year. I fill film canisters with powder and label them. Save the extra powder to refill the containers as needed. You will also need to label 6 small plastic cups for use only with the guar gum. I place one film canister of powder into each labeled cup to give to the groups.PVA Powder/SolutionPVA is available as 4% solutions in 500 ml and 1000 ml bottles, but the powder is much cheaper and is fairly easy to make yourself. I prepare five batches of the solution and store it in 2liter bottles. For the lab, I fill several 1 liter bottles with clear solution and then add several drops of food coloring to create a variety of colors for the students to use. I usually provide five colors: red, blue, yellow, green, and purple. Students may also use the clear solution to create a neat looking slime! Save the extra solution to refill the smaller bottles as needed.Follow these directions to make your own PVA 4% solution:1. Pour 1 liter of water into a microwave safe plastic bowl.2. Use a triple beam balance to measure our 40 grams of PVA powder.3. Sprinkle the powder over the water and stir until well mixed.4. Cover the bowl with plastic wrap and place in the microwave. Heat on high for 2 minutes.5. Remove from microwave and stir well.6. Return the bowl to the microwave and heat for an additional 2 minutes. Remove from microwave and stir well.7. Continue to heat the solution (2 minutes and then stir) until the solution is clear. It usually takes about 4 to 5 times before the solution turns clear.8. Pour the solution into 2 liter plastic bottles to store.TIP: Make a test batch of Super Slime to see if the amounts work well with your homemade PVA solution. You may need to adjust the amount of borax solution.  |

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| **Resources/Materials Required:** |
| Playing with Polymers PowerPoint Presentation-Includes an answer key for the student note worksheet, introduction to using graduated cylinders, and the safety rules. Step by step directions for the slimes are also provided and go along with the directions on the recipe card.Playing with Polymers Student Packet-Includes the note worksheets, puzzle pages, data chart, and slime test descriptions. Students fill in the note worksheet using the information on the first few slides of the presentation and complete the data chart as they finish the slime experiments. I require students to complete the puzzle pages on their own time.Playing with Polymers Recipe Card-print out enough recipe cards to provide 2 copies for eachgroup of 4 students. If possible, laminate the cards to help them last from year to year.Playing with Polymers Online-Students use various websites to learn about the history of polymers and plastics; I use this at the start of the unit to build background knowledge and refer to the information throughout the unit.Materials -NOTE: Suggested amounts are based on 100 students working in pairs.-Cornstarch 3 boxes (If you choose to do the optional Oobleck activity)-Mule Team Borax 1 small boxStay Flo Starch 1 large bottlePlastic containers with lids (yogurt size) One container per group; use for storing starchWhite Glue 4 oz size Need enough bottles for each pair of students.White Glue 1 gallon -Use to refill the small bottles; much cheaper to purchase per gallonGuar Gum 60 grams Available from Flinn Scientific; need 0.6 g per pair/group so one larger container will provide enough powder for several years)Film Canisters Need 1 per group; used for storing guar gum powderPVA powder Available from Flinn Scientific; need 200 grams of powder to make enough solution for 100 students; a large container will provide enough powder for several years)Food Coloring Green, yellow, blue, and red -One set for each group of 4 studentsPlastic cups 4 oz size -200Styrofoam or plastic plates 100Small plastic Ziploc style bags -2” x 3” size; need 5 per student; available at many craft stores or purchase from Uline (http://www.uline.com/) for a $11 per 1000; may also use snack size ziploc bags.Stirring Sticks -1 large box of wooden craft sticks (at least 400 sticks)Graduated cylinders-25 ml -Need 2 per group of 4 students-50 ml sizes -Need 2 per group of 4 studentsSmall beakers (or extra plastic cups) to hold water or borax solution -2 per groupEyedroppers -4 per groupTriple beam balance or other scales -1 per groupSafety goggles -1 pair for each studentPaper towelsPermanent marker -1 per groupTimer/stopwatch -1 per groupMetric ruler -1 per groupPlaying with Polymers recipes -1 set per groupPlaying with Polymers Data Chart/Slime Tests-1 per student Optional MaterialsFilm canisters -Use to store the Gloop, Boogers, or Super Slime make "farting noises!Gel style Glue -Try substituting gel glue for white glue in some of the recipes.Glitter powder -Use to make sparkling Gloop or Boogers; don’t add too much! |

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| **Student Engagement:** How will you get and hold student attention? |
| **Lesson Hook: Teacher will show a quick video on natural and synthetic polymers. The video will spark discussion among the class.** **Students will be engaged through the variety of activities completed at each station. Different learning styles will be addressed at the stations. Students will also be engaged through the use of the 1:1 computers in the classroom and will work collaboratively with their peers.** |

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| **Differentiation:**  (How will you adjust the lesson to appropriately challenge ALL students?) |
| **Students will be grouped prior to the lesson by the teacher based on ability level and behavior issues.****Differentiation will occur through the multiple days about polymers that incorporate a variety of learning styles. Two versions (levels) of the worksheet will be provided.** |

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| **IEP/504 Modifications/Accommodations:** (What curriculum modifications and/or classroom accommodations will you make for Students with Disabilities in your class? Be as specific as possible.) |
| **-Hear instructions orally and be given a written list of instructions****-Give responses in an oral/written form****-Work in a different setting (fewer distractions)****-Take more time to complete the task/frequent breaks****-Use an alarm to help with time management****-Answer fewer/different questions****-Individual redirection**  |

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| **Suggestions for Consideration and Reflection:** |
| What went well?What did you learn?What adjustments will you make moving forward?What did your assessment results indicate?Was this lesson rigorous enough to engage all students? Explain.Were the modifications/accommodations sufficient to facilitate meaningful participation for challenged students?Would you be willing to share this lesson with colleagues? If no, why not? |
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