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| **Lesson Title:** Stuck like Glue Matter | |  |
| **Grade Level:** 2 | **Quarter: 1** |
| **Standards:**  **S2P1b Changes in Objects**  Investigate changes in objects by tearing, dissolving, melting, squeezing, etc.  **Math:**  **MCC2.MD.10**  Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put together, take-apart, and compare problems using information presented in a bar graph. | | |
| **Lesson Essential Question:**  How can I observe and describe changes in matter? | **Vocabulary:**  solid, liquid, gas, properties, dissolving, changes | |
| **Lesson Materials**  water, baking soda, salt, cornstarch, clear mixing dishes or clear cups, flour, microscope (if you have access)or magnifying glasses, Graph Club, dry kidney beans, teaspoons, craft sticks for stirring, index cards | **Lesson Assessment:**  Student Journals  Teacher Observations | |
| **STEM Challenge Overview:**  You are a chemical engineer hired by the Green Glue Company. Your task is to create environmentally-sustainable glue. The solid and liquid matter you will be provided with is water, baking soda, salt, cornstarch, and flour. Your glue should be able to hold as many beans as possible. You will follow the procedures for the experiment and then choose one final mixture to submit to the Green Glue Company. As a scientist you will be asked to submit your data in a form of a bar graph. | | |
| **Teacher Background:**  Students should have background knowledge about the three states of matter. Students should be able to identify a solid, liquid, and gas. They should also be able to discuss their attributes. Students should have an understanding of creating and reading bar graphs. Teacher may want to discuss the definition of environmentally-friendly. Students should experiment with different mixtures using the liquid (water) and the solids (salt, flour, baking soda, corn starch). Allow time for students to observe and discuss the properties of each solid and the liquid before it is mixed. They may use microscopes if applicable or magnifying glasses. Also, allow time for students to discuss how the solid and liquid changed after it is mixed. In order to allow for adequate measurements, teacher should model how to measure a solid using a teaspoon and a craft stick to smooth off the top. Students will test their glue mixture by smearing their glue onto index card and placing 10 beans on top and allowing two minutes to dry. Students will then pick up index card and shake three times. They will record how many beans stuck to the card. They will repeat this 7 more times and record data. | | |
| **INSTRUCTION** | | |
| 1. **Ask/Engage**   **Day 1: 45 minutes** | | |
| Begin by discussing what students have learned about matter so far. Record results on chart paper or refer to any previous anchor charts created. Ask students, what type of matter is glue? Teacher can introduce the lesson by asking students to think, pair, share the uses for glue. Ask: What are some uses for glue? Record results on chart paper. Move students into thinking outside the classroom. Example: medical uses for gluing cuts instead of using stitches. Allow time to watch video: <http://www.homedepot.com/p/Gorilla-Glue-2-fl-oz-All-Purpose-Adhesive-269/100130236>  This will enable students to see the many uses for glue outside the classroom. Review the STEM challenge.  **Challenge**:  You are a chemical engineer hired by the Green Glue Company. Your task is to create glue that is environmentally sustainable. | | |
| 1. **Imagine/Brainstorm**   **Day 2: 60 minutes** | | |
| Introduce the constraints of the design plan:  **Criteria:**   1. Use ingredients provided. 2. Glue must hold as many beans as possible on an index card. 3. Follow the chart provided. 4. Create a graph showing your results on Graph Club.   **Constraints:**   1. You may only use the ingredients provided. 2. You must work with your group. 3. You may only make 8 different mixtures.   Define the criteria for success. Ask each student to work independently to come up with 1-2 possible design solutions. Students should draw/label their designs. This would be which mixture and which ratio they believe will work the best. They may also estimate how many beans it will hold. | | |
| 1. **Plan/Design**   **Day 2: Continued** | | |
| Each student presents their ideas to their team. Student teams collaborate to come up with final design plan. This would be which mixture and which ratio they believe will work the best. They may also estimate how many beans it will hold. Students draw final design plan and make a list of needed supplies. All groups will need each of the solids and water in order to make adjustments to their plan. | | |
| 1. **Create / Test**   **Day 3: 60 minutes (this may be broken up in two days or extend time as needed)** | | |
| Student teams build their design (this is their mixture) according to their design plan. This would be a good time to allow for students to either use microscopes or magnifying glasses to observe the solids and discuss their attributes. Students test their design plan and record data. Students will test each type of matter they create by mixing the solids with the water. Students will choose the best sticking glue mixture as their end result. Students can create graphs during math or during this time using Graph Club showing how many beans each mixture held. Students are actually evaluating and improving on their design as they create new mixtures. | | |
| 1. **Evaluate/Improve –** and repeat Steps 1-5   **Day 4 or 5: 60 minutes** | | |
| Students evaluate their design for success. Did it meet the established criteria? Did their final design match their planned design? How would students improve their design? Students will reflect in their journal or use pages provided. | | |

**Suggested extensions:**

\*students may design packaging and label for their glue

\*students may write and act out a commercial advertising their glue (this can be filmed)

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**Stuck Like Glue Matter**

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| **Glue Ingredients and Sticky Test Results** | | | | | | |
| Mixture | teaspoons of salt | teaspoons of flour | teaspoons of  cornstarch | teaspoons of baking soda | teaspoons of water | sticky test #beans |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |

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**Stuck Like Glue STEM Challenge**

**2nd Grade**

**Challenge**:

You are a chemical engineer hired by the Green Glue Company. Your task is to create glue that is environmentally sustainable.

**Criteria:**

1. Use ingredients provided.

2. Glue must hold as many beans as possible on an index card.

3. Follow the chart provided.

4. Create a graph showing your results on Graph Club.

**Constraints:**

1. You may only use the ingredients provided.
2. You must work with your group.
3. You may only make 8 different mixtures.

**Materials:**

water, baking soda, salt, cornstarch, clear mixing dishes or clear cups, flour, dry kidney beans, spoons , craft sticks, index cards

1. **ASK / ENGAGE:** What is the problem you are being asked to solve?

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1. **IMAGINE/BRAINSTORM:** What are some possible solutions to the problem that you are trying to solve? After you brainstorm, draw and label your ideas below.

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| **Idea #1** | **Idea #2** |

1. **PLAN/DESIGN:** Share your ideas with your group and collaborate to decide on a final design plan. Draw your team’s design below and make a list of the materials that you will need to complete your design.

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| **Team Design Plan** | **Materials List** |

1. **CREATE/TEST**: Use your Final Design Plan to create and build your solution. Test your design. Did it work? Why or Why not?

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1. **EVAULATE/IMPROVE:**  How well did your design work? Did your solution solve the problem within the given constraints?

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How can you improve your design? How can you make it better? Draw and label your improved design below.

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| **Improved Design Plan** |