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| **Lesson Title: Pop Goes the Rocket** |  |
| **Grade Level:** Second | **Quarter:**1 |
| **Standards:** **S2P1. Obtain, evaluate & communicate information about the properties of matter & changes that occur in objects.**Describe & classify different objects according to their physical properties. Explain how structures made from small pieces can be disassembled & then rearranged to make new/different structuresObserve & construct an explanation that some changes in matter caused by heating & cooling can be reversed & some changes are irreversible. |
| **Lesson Essential Question:** **EQ: How can I create a rocket using what I know about matter?**  | **Vocabulary:**Solid, liquid, gas, states, matter, identify, investigate, dissolving, changes, vinegar, baking soda, safety glasses |
| **Lesson Materials**Plastic container with pop-off lid (like a film canister) Open cups**Safety Goggles-\*\* Should be worn whenever you are working with baking soda and vinegar\*\***Baking SodaVinegarMeasuring spoonsMeasuring cupsTimerWax paperIpads/Digital camera to record videos  | **Lesson Assessment:** Student JournalTeacher ObservationStudent measurements data/results |
| **STEM Challenge Overview:**Did you know that you can mix a solid and a liquid to make a gas? What if you could capture that gas in a closed container and use it as a form of energy to power a rocket? NASA is looking for new ways to launch rockets into space and they need your help! NASA knows that mixing baking soda (a solid) and vinegar (a liquid) will cause gas bubbles to form, but they don’t know the best recipe mix for launching their rockets the highest. You need to figure out how much solid baking soda to add to 1 tablespoon of liquid vinegar to make the most gas bubbles. |
| **Teacher Background:**For this challenge be sure to discuss safety, you should model how to make your own version of this challenge. Normally this would not be recommended but this will make it much SAFER for the students to have the background knowledge. Watch this video prior to doing this experiment if you have never done it before. <https://www.youtube.com/watch?v=vTlvkXWzfXk>  |
| **INSTRUCTION** |
| 1. **Ask/Engage (Day 1 30 Minutes)**
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| * Begin by dressing up as a scientist (white lab coat, safety glasses, etc.) and show the students a bottle of vinegar and baking soda. Open the vinegar and smell it, then say wow science/matter sure can be stinky! Now tell the students that we are going to go outside to conduct an experiment.
* Conduct the experiment from the Youtube video above. This is different than the students challenge but will give them a great idea of what they will be doing.
* After conducting the experiment tell the students that they are going to be making their own rockets!
* Go back inside and read the challenge:

NASA is looking for new ways to launch rockets into space and they need your help! NASA knows that mixing baking soda (a solid) and vinegar (a liquid) will cause gas bubbles (carbon dioxide) to form, but they don’t know the best recipe mix for launching their rockets the highest. You need to figure out how much solid baking soda to add to 1 tablespoon of liquid vinegar to make the highest flying rocket. Have fun and BLAST off!  |
| 1. **Imagine/Brainstorm Day 2 (30-45 minutes)**
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| * Introduce the constraints of the design plan. Define the criteria for success*.*

Criteria: * You will be given 1/3 cup of baking soda and 1/2 cup of vinegar and 3 plastic cups to practice with.
* You should test different mixture amounts to see which combination makes the most bubbles (carbon dioxide).
* Make sure to keep track of the amount that you have measured.

Constraints: * Use your baking soda and vinegar wisely. It is not unlimited.
* You may only use the materials provided.
* You must complete this in 2 STEM lab days.
* Students will each create their own mixture/recipe prior to testing.
* **DO NOT FORGET TO HAVE STUDENTS WEAR SAFTEY GLASSES!**
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| 1. **Plan/Design (Day 2 continued)**
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| * **DO NOT FORGET TO HAVE STUDENTS WEAR SAFTEY GLASSES!**
* Once students each create their own mixture, have students begin testing in groups to see how much carbon dioxide is formed (gas bubbles). **Be sure your tables have paper towel for messes or conduct test outside.**
* **Students will pick the mixture they think is best for the following day.**
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| 1. **Create / Test (Day 3-4, 30 minutes) You may need 2 days for them coming up with the best possible mixture.**
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| * **DO NOT FORGET TO HAVE STUDENTS WEAR SAFTEY GLASSES!**
* Once you are confident that you know the best combination recipe to make your rocket go the highest, you will test your combination recipe in a closed plastic container with a pop-off lid outdoors.
* You will need to use a timer to clock the amount of time that the rocket (pop lid) stays in the air. Be sure students record how long it stays in the air.
* You will compare your results with your other classmates by graphing those results to see whose rocket stayed in the air the longest.
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| 1. **Evaluate/Improve –** and repeat Steps 1-5 **Day 5, record videos, share with class.**
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| *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?** While students are testing they may work on improving their mixture as they go*.*
* **Once students have their best possible mixture let them record videos on iPads/tablets, etc.**
* **Have students share their videos with the class as a closure to this lesson.**
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Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Pop Goes the Rocket

 2ndGrade

![C:\Users\sse11532\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\0YW3X8NY\rocket_red[1].png]()

**Challenge**: NASA is looking for new ways to launch rockets into space and they need your help! NASA knows that mixing baking soda (a solid) and vinegar (a liquid) will cause gas bubbles (carbon dioxide) to form, but they don’t know the best recipe mix for launching their rockets the highest. You need to figure out how much solid baking soda to add to 1 tablespoon of liquid vinegar to make the highest flying rocket. Have fun and BLAST off!

**Criteria:**

1. You will be given 1/3 cup of baking soda and 1/2 cup of vinegar and 3 plastic cups to practice with.
2. You should test different mixture amounts to see which combination makes the most bubbles (carbon dioxide).
3. Make sure to keep track of the amount that you have measured.

**Constraints:**

1. Use your baking soda and vinegar wisely. It is not unlimited.
2. You may only use the materials provided.

**Materials:** plastic containers with pop-off lid (film canister), open cups, SAFETY Goggles, baking soda, vinegar, measuring spoons, measuring cups, timers

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** |