

Amanda Gylling

Lesson: Bottle Rocket Experiment

Grade: 2

Time Duration: 1+ hours

Objective:

- For students to work in groups of 3-4 to build a bottle rocket launch.
- Groups will launch their rocket, then estimate the distance traveled before measuring, to see which one traveled the furthest.

Second Grade Oregon State Standards:

- Measure and estimate lengths in standard units
 - [.CCSS.MATH.CONTENT.2.MD.A.1](#) Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
 - [CCSS.MATH.CONTENT.2.MD.A.3](#) Estimate lengths using units of inches, feet, centimeters, and meters.
 - [CCSS.MATH.CONTENT.2.MD.A.4](#) Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

Materials Needed:

- (1) two-liter soda bottle per group
- A couple pencils/markers
- Duct tape
- A cork that fits inside the soda bottle
- Small paper towel squares
- Baking soda
- Vinegar
- Cardboard or wood base
- Yardstick, meter stick, or tape measure
- A couple small wooden blocks

Procedure:

1. Gather students on the rug. Open the lesson by having students review how many inches are in a foot and how many feet are in a yard. (review of background knowledge).

2. Explain that it is time for students to put their knowledge to work. The class will be participating in a bottle rocket challenge. The goal is for each group to design a rocket with a base that will help it launch into the air, once the baking soda/vinegar are added (demonstrate by turning the soda bottle upside down).
3. Once in groups of 2-3, students will first meet together to plan/brainstorm how to create the base. They will have access to computers if they want to research different types of rocket bases to create. Once they agree upon a base, they will get to work with the materials.
4. Students will have approximately 30 minutes to plan/brainstorm and 30 minutes to design their prototype.
5. Students will gather with their rocket and base in an outdoor, open space (depending on how much baking soda/vinegar you add depends on how high they will go. Allow for plenty of space).
6. To keep the baking soda/vinegar variable the same for all groups, add 3-4 Tbls of baking soda to a small paper towel square. Fold the paper towel around it.
 - a. Pour 1 cup of vinegar into the bottle (use the same amount for each group). Once the vinegar is in, quickly push the baking soda packet down into the bottle and put the cork on (not too tightly).
7. Quickly turn the bottle upside down and set it up on the cardboard/wood base on its stand. Then, stand back and prepare for it to launch!
8. Once it launches, each group needs to use their graphic organizer to first estimate the distance it traveled from the base (the group that's launching will estimate, all the other groups will record this number).
 - a. All groups record so that at the end of the lesson, data comparisons can be made between groups.
 - b. Then, the launching group uses their measurement tool to measure the actual distance. This is recorded by all groups.
9. Repeat steps 6-9 for each group. Record estimates and actual measurements.

Whole Group:

1. Come back together on the rug and analyze results (record each group's distance on the whiteboard).
 - a. Which group's rocket went the furthest? Did they launch it straight up or at an angle? (see if students can find any patterns related to the type of rocket stand and how that affected the distance).

Assessment:

- Students would self-assess themselves as well as their group, based on a rubric (see below).
- I would assess each individual based on a rubric (see below).

Closure/Follow-up activities: here are a couple different options for a closing activity:

- Students could gather in groups again to brainstorm how to redesign their prototype
- Students could plan a follow-up activity to this, changing one variable from the experiment (ex: different amounts of baking soda and vinegar, launching the rocket at different angles, using different size bottles, etc).

STEM Careers that this lesson may lead to:

- Research Scientist
- Aerospace Engineer
- Computer Engineer
- Astrophysicist

Rubrics (see below):

Quick Peer Evaluation Form

Name _____ Class Period _____ Date _____

Write the names of your group members in the numbered boxes. Then, assign yourself a value for each listed attribute. Finally, do the same for each of your group members and total all of the values.

Values: 5=Superior 4=Above Average 3=Average 2=Below Average 1=Weak

Attribute	Myself	1.	2.	3.	4.
Participated in group discussions.					
Helped keep the group on task.					
Contributed useful ideas.					
How much work was done.					
Quality of completed work					
Totals					

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Group Self Evaluation Checklist

Name _____ Class Period _____ Date _____

Topic of Study _____ Group Members' Names _____

As a team, decide which answer best suits the way your team worked together. Then, complete the remaining sentences.

We finished our task on time, and we did a good job!	<input type="checkbox"/> YES <input type="checkbox"/> NO
We encouraged each other and we cooperated with each other.	<input type="checkbox"/> YES <input type="checkbox"/> NO
We used quiet voices in our communications.	<input type="checkbox"/> YES <input type="checkbox"/> NO
We each shared our ideas, then listened and valued each other's ideas.	<input type="checkbox"/> YES <input type="checkbox"/> NO
We did best at	
Next time we could improve at	

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Cooperative Learning Rubric

Name _____ Class Period _____ Date _____

Category	4	3	2	1
Contribution to Group Goals Score: _____	Consistently and actively works toward group goals; willingly accepts and fulfills individual role within the group.	Works toward group goals without occasional prompting; accepts and fulfills individual role within the group.	Works toward group goals with occasional prompting.	Works toward group goals only when prompted.
Consideration of Others Score: _____	Shows sensitivity to the feelings and learning needs of others; values the knowledge, opinion, and skills of all group members.	Shows and expresses sensitivity to the feelings of others; encourages the participation of others.	Show sensitivity to the feelings of others.	Needs occasional reminders to be sensitive to the feelings of others.
Contribution of Knowledge Score: _____	Consistently and actively contributes knowledge, opinions, and skills without prompting or reminding.	Contributes knowledge, opinions, and skills without prompting or reminding.	Contributes information to the group with occasional prompting and reminding.	Contribute information to the group only when prompted.
Working and Sharing with Others Score: _____	Helps the group identify necessary changes and encourages group action for change; does assigned work without reminders.	Willingly participates in needed changes; usually does the assigned work and rarely needs reminding.	Participates in needed changes with occasional prompting; often needs reminding to do the assigned work.	Participates in needed changes when prompted and encouraged; always or often relies on others to do the work.
Total Overall Score _____	Comments:			