



Minor Challenge Set #4

STEM Field: Mechanical Engineering

Level: Junior

Challenge Name: Baking Soda and Vinegar Powered Car

Project Cost: 0-20 USD

Materials Required:

- Disposable water bottle (square one is best)
- 1 straw
- 1 skewer
- Scissors
- 4 plastic caps (or other round disks that are all the same size)
- 4 pony beads (good but optional)
- Glue gun or other glue
- Duct tape
- Vinegar
- Baking soda
- Tissue paper

Safety:

- Have an adult help when you are handling the scissors or hot glue (other glue will work but will take longer as you may need to wait for it to dry throughout the experiment)

Duration:

- This challenge will take approximately an afternoon to finish, however, the time guideline is an estimation only, and students and mentors can complete the tasks around their schedules

Introduction:

Cars or buses that we see on the street work by having an engine that turns the wheels propelling the vehicle forward. These engines are typically powered by gasoline but engines powered by electricity are becoming more common too.

In today's experiment we're going to build a car that will be powered by baking soda and vinegar. When the baking soda and vinegar are mixed together they will react to produce a lot of gas. This gas will escape through a small hole in the car and this will push the car forwards. The wheels will not be powered by the reaction but they will be able to turn allowing the body of our car to push itself forward.

Instructions:

Build your Car

- 1) Once your glue gun is hot, melt a small hole in the water bottle lid with the tip of the glue gun. If you are not using a glue gun, use something else to poke the hole such as a skewer. This is shown in figure 1.

Note: Be very careful when handling the glue gun. Ask an adult for assistance if you need to use other materials to poke the hole.

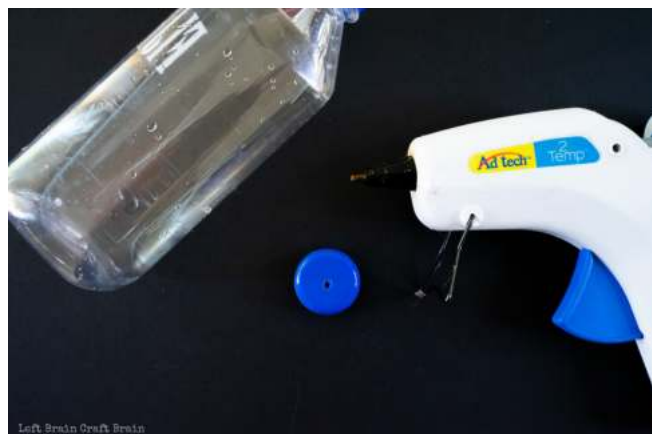


Figure 1: Make a hole in your bottle cap

- 2) Cut your straw in half and then measure the length of each half.
- 3) Cut your bamboo skewer into two pieces. Each bamboo piece should be 2.5 cm (or 1 inch) longer than the straw halves.
- 4) Decide what material you will use to make the wheels. The wheels will need 4 same-sized disks, so choose your material carefully!
- 5) You can make the wheel using 1 of the below 2 ways:
 - a) If you are using beads, glue the bead to the inside of the bottle cap (or the material you picked as your 4 same size disks for the wheels). Then, put some glue in the centre of one of the beads and then insert the end of one of the skewers.
 - b) If you are not using beads, put some glue on the centre of each wheel and stick it to the end of one skewer.
- 6) Now slide one of the straw halves over the skewer glued to the wheel. The result of steps 2 to 6 are shown in figure 2.



Figure 2: The first wheel is attached to a skewer.

- 7) Then glue another one of the wheels to the free end of the skewer. You have now completed the first axle!

- 8) Repeat steps 5 to 7 to make the second axle. The completed axles are shown in figure 3.

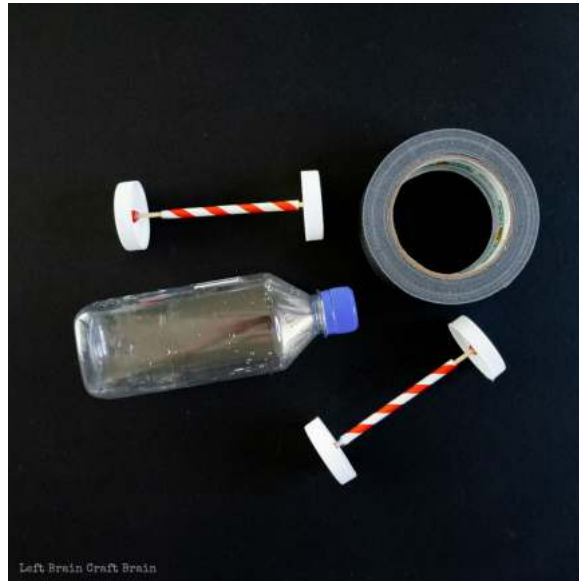


Figure 3: The two axles and car body

- 9) Tape the paper straw halves parallel to each other and to perpendicular to the long direction of the bottle. This is shown in figure 4.

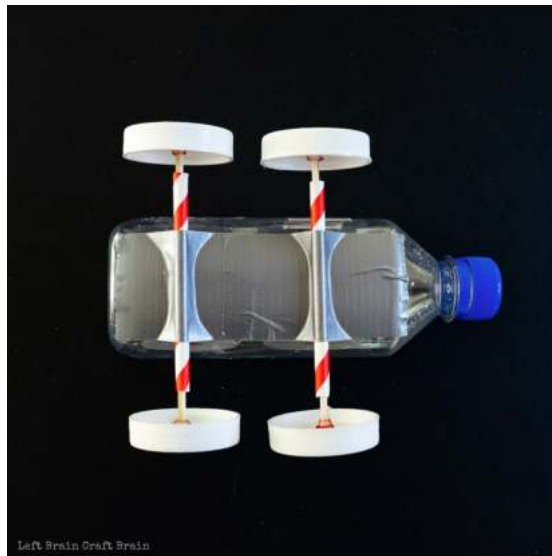


Figure 4: The body of the car with the two axles attached.

- 10) Duct tape the two paper straws to the bottle like axles.
- 11) You've finished building your car!

Reaction to Power the Car

Note: You'll want to complete steps 15 and 16 of this section outside as it gets messy!

- 12) Put 1 cup of vinegar into your water bottle.
- 13) Cut a piece of tissue paper that is about 13x10cm (or 5x4inch).
- 14) Place about 1 tablespoon of baking soda in the centre of the tissue paper. Then roll up the tissue paper around the baking soda and fold the ends over so the baking soda doesn't spill out.
- 15) Quickly drop the baking soda package into the bottle and close the lid.
- 16) Shake the bottle, place the wheels on the ground and watch your car go!

Extension

It's very important to get the baking soda into the bottle as quickly as possible. This makes sure that as much of the reaction as possible will power the car. Can you create a tool to add the baking soda faster?

If your car is more aerodynamic it will travel further. Try adding fins to see if this changes how far your car will go.

Reflection Questions:

- Are there any improvements you would make to this challenge?
- What real world application/s can you apply this challenge to?
- What are the key science and engineering concepts that relate to this challenge?

- How far was your car able to go?
- Did your modifications change how far your car was able to go? How much did the distance change?
- What do you think would happen if you made the wheels bigger or smaller? Give it a try if you'd like!

Submission Guidelines:

- Submit a photo of the car. Include a short summary that addresses the reflection questions.

Note: Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your parent or guardian first.

- The submission form is on the Minor Challenges page:
<https://sciencechallenge.org.au/index.php/minor-challenges/>
Fill out the details and make sure you upload your submission.

Learn More! Resources:

- To learn how a car engine work check out the video here:
<https://easyscienceforkids.com/how-a-car-engine-works-video-for-kids/>

- The learn more about how chemical energy (like gasoline or baking soda and vinegar reactions) transfer to the rotational energy of the wheels check out this link:
<https://www.generationgenius.com/energy-transfer-lesson-for-kids/>

Bibliography:

- Left Brain Craft Brain. n.d. *Chemical Reaction Car Recycled STEM Project*. [online] Available at:
<<https://leftbraincraftbrain.com/chemical-reaction-car-recycled-stem-project/>> [Accessed 10 April 2022].