

Design Challenge: Making a Bottle Rocket

In this design challenge, your child will be asked to create a bottle rocket using typical household items. The list of materials includes everything they will need to create and launch a rocket, and we have listed a variety of ingredients your child can use to make “fuel.” Not all of the listed ingredients will necessarily be successful in launching the bottle--the goal is to allow your child to experiment with different mixtures until they find a combination that works. How your child chooses to launch the bottle is up to them, but we have given instructions for you to help guide them along the design thinking process. Make sure to supervise as your child blasts off into this science experiment of fun!



What You Need:

- Disposable water bottles
- 4 pencils to act as stabilizers
- Duct tape
- Open outdoor space to launch your rocket
- Pen and paper for note-taking
- Fuel mixture ingredients for your child to experiment with (Not all of these will necessarily be successful.): Baking soda, salt, Mentos, vinegar, lemon juice, soda (such as Diet Coke), sugar

What You Do:

1. First, explain the task to your child so that they have a clear understanding of the prompt. Reiterate that they need to create a bottle rocket and a “fuel” mixture that will launch in the air. Tell them that the materials you have given them will be useful, but it’s up to them to decide if they will use all of them, specifically the fuel mixture ingredients.
2. Ask your child to **define** a bottle rocket and its characteristics. It’s important for your child to have a clear understanding of what a bottle rocket is before they decide how to make their own. Feel free to look up pictures of bottle rockets online as an example, but leave some ambiguity so that your child can be creative in the design process. Some questions you can ask your child:
 - a. What does a bottle rocket look like?
 - b. What are some important parts of a rocket?
 - c. What are stabilizers?
3. Once your child understands the requirements of this challenge, allow them to **ideate**. Ask them to brainstorm different ways to construct the bottle rocket, as well as different combinations of ingredients they can use to create “fuel.” Encourage your child to take note of their ideas by drawing or writing them on a piece of paper.
4. After your child is done brainstorming, ask them to choose the design they think will work best. This is an important step in the design thinking process because it teaches your child to prioritize the functionality of their design over personal preferences. This also prevents your child from getting too emotionally attached to their ideas.
5. Now, it’s time to begin **prototyping** (building)! Give your child all the materials and allow them to begin making the design they chose in the previous step. We suggest that they first create the actual bottle rocket, and then focus on making the “fuel” in an outdoor space.
 - a. When your child is ready to test different combinations for the rocket’s “fuel,” supervise them in an outdoor space to ensure their safety. We recommend testing the mixtures in a separate bowl before putting them in the rocket. This way, you won’t need to clean out the bottle rocket each time your child tests a different mixture.
6. Once your child is done building, it’s time to **test** their prototype (design)! Go into an open, outdoor space before attempting to launch. Ask your child the following questions as they test their rocket:
 - a. Does the rocket successfully launch in the air?
 - b. Does the rocket hold its structure?
7. If your child’s rocket is unable to launch and/or keep its structure, make sure that they aren’t discouraged. Frame this as an opportunity to try again, and help your child identify where their design went wrong. Continue repeating the process of brainstorming, prototyping, and testing until your child creates a bottle rocket that they are proud of!