

# Having a Ball with Chemistry

**Grade level** Target grade = 10 and *scalable* down to grade 8 and up to grade 12

**Subject area(s)** Chemistry

**Estimated Time Required** \_120 minutes



**Image 1**

**Image file:** <https://goo.gl/images/1v4fmj>

**ADA Description:** A photograph showing thirteen bouncy balls all consisting of different colors and sizes.

**Source/Rights:** © Google Images Public Domain Pictures

**Caption:** Making bouncy balls like the ones sold in stores!

## Maker Challenge Recap

Students work as material science engineers to develop the bounciest ball using the allotted materials. Students will develop a plan of what materials are needed to make their product bouncy. There will be time given to re-design and retest their creations.

## Maker Materials & Supplies

- Give students a range of materials from different brands of borax, cornstarch, Elmer's glue (each of these materials could be used with different brands and types). For example, the glue could be white or the different varieties they have such as red, purple or glitter
  - You can also provide other products such as baking soda, salt, sugar to have as extra materials that allows students to think of whether those can create a bouncy ball.
- Lab equipment needed: Metric ruler, hot plate, water (can be varied in temperature), gloves and apron
- Mixing equipment: Ziploc bags, clear cups (12 oz) or less, wooden craft sticks or plastic spoons, measuring spoons (preferably tablespoons and teaspoons so that students are not prone to use high amounts of materials)
- Students should have phones or tablets for research purposes.

## Kickoff

Companies are in constant competition to create the best product possible whether it be in fast food, cars, video games and even toys.

Toy companies want products that are cheap to make but are worthwhile to sell. In recent years, they have also had the need to negotiate with entertainment industries to create commercials that entice children to their product. The [insert your own toy company name] is a brand-new company in search of material and chemical engineers who can create the bounciest ball at a low cost.

Today your challenge is to create the bounciest ball out of the materials given. You will work with one other team member to create your product. It is important to note that all the materials given are safe to handle but not safe to eat. You and your partner can use as much or as little of any product possible. Keep in mind that you must create the most cost effect ball, meaning you want to use the least amount of materials

Once your product is created, you will measure the width of your ball as well as measure how far your bouncy ball bounces. The team with bounciest ball will win and get the contract to work with the new [insert toy company] who is starting their engineers at a salary of \$97,000!

## Resources

- [https://www.youtube.com/watch?v=4h6m\\_wrOpm4](https://www.youtube.com/watch?v=4h6m_wrOpm4)
  - Video to engage students and how this toy company uses their bouncy balls for other fields.

## Maker Time

Pair students up. First, let the students brainstorm ideas on how to create their product. Brainstorming should not be longer than 15 minutes. They can research what the use of each solid and liquid reagent available to them works. Once students create a good sketch plan, let students create their ball. A good sketch plan is one in which they write down approximately how much of each material they think they'll want to use as well as how to mix them. You could let students walk into the lab area and see what they're working with.

Creating a bouncy ball from scratch can be hard. Let students synthesize their first prototype. Some may succeed on their first try but many may fail. Let students know that they will not be given points off if they fail. As part of being scientists or engineers, it is important they know that they can redesign and retest their product. As pairs may fail, let them know that this is the real world and they can talk to other groups for help, but they cannot copy someone else's idea. Synthesis and reiterations should not take more than 30 minutes.

Make sure students write down their exact synthesis amount and procedures. Their product should be replicable, so a clean set of their directions should be produced in the end.

If a student is successful, then they can measure their ball bounce height. The group with the bounciest ball wins. (10 minutes should be allotted to test their bounce heights). A variation or addition that can be added is to have student record their bounce heights so that we have accurate results from each group. You can also have all groups wait until everyone has made a ball and measure them all at the same time.

This lab can get very messy so it's important that pairs work efficiently. As a teacher, you should also make sure that they are not throwing away glue into the sink, rather have a bucket or cup where they can throw their leftover waste. Any solid waste can go in the trash.

In the case of a tie, you can determine the tie-breaker to be the cost of producing the ball. See the cost of items document.

## **Wrap Up**

As they are competing for the top spot then have students place their bouncy ball height on the board for various periods to see and add their data onto.

Additionally, you could have students create a commercial or advertisement of their product. This would allow them to work collaboratively while also thinking of ways to engage other people into what they created.

## **Tips**

1. The lab can get messy so keep in mind that you will need paper towels or wipes to clean lab area.

2. Do not let students throw away any glue product into the sink. If students and when students want to clean their hands then they must first wipe them on paper towels, then clean their hands with soap and water.
3. Any water waste can be thrown down the sink. Any glue or solid materials should be thrown away in the trash.
4. 1 possible solution to make a bouncy ball is as follows: 2 tablespoons of water, 2 teaspoons of borax, 1 tablespoon of cornstarch and 1 tablespoon of Elmer's glue.

**Supporting Program NEWT (Nano Enabled Water Treatment) research experience for teachers (RET) program, Rice University. Project number: NSF EEC-1449500**

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Name: \_\_\_\_\_ Partner: \_\_\_\_\_ Date: \_\_\_\_\_

### Having a Ball with Chemistry!

1. **Brainstorm:** Describe what materials you will use and how much. Also, describe how you will go about doing that, what are your steps?
2. What are your constraints? Does your design have to meet certain criteria?
3. **Create it!** Follow your steps and material list. Do not deviate from it.
4. **Test it out:** If it worked, great! You can test it below. If not, that's ok! You can go back and determine what went wrong with your design synthesis.
  - a. What worked?
  - b. What didn't work?
5. **Iterate:** If it didn't work, what are you changing in your product?

**If you were able to create a bouncy ball then test it out.**

1. Have your meter stick stand vertical from the ground as you hold it. You will drop your ball from the 1 meter mark. You will need your partner to determine the height of the first bouncy ball. What is the height of the bounce height? Place your data on the table. We will then have a group competition to ensure other competitor that the data is not skewed.
2. Below write your detailed procedures of how you created your ball. Make sure that it is detailed enough for someone else to recreate it.

The background of the slide features several colorful Easter eggs. One egg in the foreground is painted with a pattern of blue, red, and yellow. Another egg to its right is painted with large sections of purple, pink, and green. In the background, there are more eggs with various patterns, including one with a colorful, abstract design. A dark blue horizontal bar is positioned at the top of the slide, and a larger dark blue rectangular box is at the bottom, containing the title and author's name.

# HAVING A BALL WITH CHEMISTRY

SELENE REYES

# REAL TOY COMPANY

- [https://www.youtube.com/watch?v=4h6m\\_wrOpm4](https://www.youtube.com/watch?v=4h6m_wrOpm4)

# KICKOFF

- Companies are in constant competition to create the best product possible whether it be in fast food, cars, video games and even toys.
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## THE CHALLENGE!!

- Today your challenge is to create the bounciest ball out of the materials given. You will work with one other team member to create your product. It is important to note that all the materials given are safe to handle but not safe to eat. You and your partner can use as much or as little of any product possible. Keep in mind that you must create the most cost effect ball, meaning you want to use the least amount of materials
- Once your product is created, you will measure the width of your ball as well as measure how far your bouncy ball bounces. The team with bounciest ball will win and get the contract to work with the new [insert toy company] who is starting their engineers at a salary of \$97,000!

## KEEP UP WITH THE COSTS!

<b>Supplies Used</b>	<b>Amount</b>	<b>Cost</b>	<b>Total Cost</b>
Water		\$0.30/ tablespoon	
Glue Stick		\$1.00/ stick	
Cornstarch		\$0.20/ tablespoon	
Elmer's Glue		\$0.40/ tablespoon	
Baking Soda		\$0.25/ teaspoon	
Salt		\$0.10/ teaspoon	
Sugar		\$0.20/ teaspoon	
Borax		\$0.15/ teaspoon	
Yellow Wood Glue		\$0.50/ teaspoon	
<b>Total Cost</b>			

# MAKER TIME-MATERIALS

- Cornstarch
- Salt
- Sugar
- Borax
- Glue
- Water (room temp)
- Hot plate
- Wooden sticks(to stir)



## OBSERVE

- Observe the materials available to you. Ask yourself (What reagents (solids or liquids) can I combine to make my bouncy ball? You can look at the physical properties of the materials. (3 minutes)

# MAKER TIME-BRAINSTORM

- Get into pairs
- Brainstorm ideas on how to create your prototype.
- You can look at materials and touch if desired, but do not start yet.
- Sketch out a detailed plan with quantities
  - For example “We will use 1 tablespoon of borax and 1 tablespoon of glue combined”
- When you are done show your instructor and start synthesizing

## MAKER TIME-SYNTHESIZING (30 MINUTES)

- Start synthesizing your ball.
- If you succeed proceed in your lab
- If you fail.....THAT'S OK!
  - Modify your procedures
  - Make sure you write down exactly what you changed