

Bioplastic Helmet for your Egg!

Estimated Time: 90 minutes

SUMMARY

In this activity, students will learn how to build a bioplastic helmet that they can use to protect their eggs. Students will then test out the effectiveness of that helmet when they roll their egg, with their bioplastic helmet, down a ramp. After putting their helmets to the test, students learn where their egg cracked by dyeing them.

WHAT YOU'LL LEARN

- How to make a simple polymer
- Engineering design skills
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Materials Used	Resources Used
<ul style="list-style-type: none"> • Eggs • Cooking equipment for eggs (see Resources section) • Pencil and paper (ideally graph paper) <p>Bioplastic Helmet</p> <ul style="list-style-type: none"> • 1 Tbsp. cornstarch • 5 Tbsp. cold water • 1 tsp Vegetable Oil • 1 sandwich bag • 1 toy car • 1 medicine cup • A ramp <p>Egg Dyeing</p> <ul style="list-style-type: none"> • 1 cup or bowl • 1 cup of hot water • 1 tsp. white vinegar • Food coloring 	<ul style="list-style-type: none"> • Steaming Eggs: https://www.serious-eats.com/recipes/2014/04/steamed-hard-boiled-eggs-recipe.html • Hard Boiled Eggs: https://www.youtube.com/watch?v=xUHKpHek2E8 • Making Bioplastics: https://www.youtube.com/watch?v=kjvQMMQWNGE&t=243s

WHAT TO DO

Hard Cooking Eggs

1. Refer to the Egg Drop activity to learn the best way to boil an egg.

Bioplastic Helmet

1. Place 1 Tbsp. cornstarch in a sandwich bag.
2. Add 1 tsp vegetable oil and 5 Tbsp. water into the bag and mix.
3. Do not completely seal the bag. Place the partially sealed bag in a microwave oven on high for 30 seconds. Be careful — the bioplastic will be very hot.
4. Once you are able to handle it safely, mold it into a helmet shape. It may work best to attach it to the egg at this time.
5. Allow the helmet to cool and harden for several minutes.

Testing the Helmet

1. Create a small ramp that a toy car will easily roll down. A 20 to 30 degree angle works best.
2. Attach the medicine cup to the toy car and place the egg with the bioplastic helmet on it in the car.
3. Roll the toy car down the ramp and watch it crash.
4. Roll an egg without a helmet in the same car down the same ramp for comparison.

Dyeing Eggs and Evaluating Egg Protection

1. Refer to the Egg Drop activity to learn how to dye your egg and why dyeing your egg is an important step.

Helmet Redesign

1. Now that you have tested your egg with the helmet and without, evaluate if you want to place the helmet in a different location on the egg. Do you want the helmet to go all around the egg, or maybe place the helmet on the side of the egg rather than the top or the bottom.
2. Roll your car toy with egg passenger down the ramp again and see what happens.

TIPS

- It isn't necessary to cook the eggs, but it's more fun to color the eggs to determine where they cracked and to be able to eat them afterward. No reason to waste eggs.
- Video recording the car crash to see how the egg, with and without its helmet, holds up. Make sure you record the point of impact. This video can make for valuable piece of evidence for you and your kid to review and rethink the design. We have all seen slow motion impact videos.
- This testing activity can be repeated to optimize the design and test again. This is an important step in the engineering design process, and provides a great extension to the activity. The key is to have your student compare the results of each test and explain why things changed. Explaining why is the difference between simply repeating the process and optimization.