

Title

Unpoppable Balloon

Activity Overview

Description

Learn some properties of materials by discovering how to insert a skewer into a balloon without it popping! This will demonstrate how molecules behave when experiencing high and low tension. This activity can be done as a group, but it also functions as a great demonstration, especially for younger ages.

Topic Area(s)

Engineering, Chemistry

Grade Level

Grade 1+

Duration

Demo:10-15 mins; Group: 30+ mins

Learning Outcomes:

- Learn the importance of understanding properties of given materials
- Learn some characteristics of how molecules behave

Hook

Try your best, but this balloon will not pop!

Background Information

Rubber is made of long, stringy, elastic chains of molecules. These molecules are flexible, which enables balloons made of rubber to be stretched and blown up. When a balloon is deflated, the molecules are densely packed and experiencing hardly any tension. When the balloon is inflated, the molecules are stretched out, experiencing great tension. However, even on an inflated balloon there are points of low tension, such as the button on the tip and the tie-off. When an object is inserted into a denser area of rubber molecules, the molecules flex and squeeze around the skewer, making a very tight seal. To create an unpoppable balloon, the low tension locations are taken advantage of making it possible to push a skewer into a balloon without it popping.

As an Engineer, it is important to understand the properties of materials, and how they interact with other objects, in order to create successful projects.

Materials

For 1 demonstration (or per child):

- 1 balloon
- 1 Tbsp vegetable oil
- 1 wooden barbeque skewer (ensure skewer is straight and not rough or splintering)

Safety Considerations

Incase children are sensitive to loud noises, warn them that the balloons may pop! Remind the group to be careful when using skewers.

Procedure

1. Inflate then deflate the balloon to stretch it out.
2. Blow up the ballon and tie it off, making sure it is shorter in length than the skewer. Younger children may need assistance tying the knot.
3. Holding the balloon gently with one hand, begin to poke the barbeque skewer through the thick button (small bump at the top of the balloon). At this point, you may need to rub a small amount of vegetable oil on the point of insertion to assist the skewer getting through.
4. Twist and carefully push the skewer through the balloon. Eventually the skewer will work its way through.
5. To make an exit hole, aim for the skewer to poke through the thick rubber neck where the balloon is tied.
6. Once again, gently push the skewer through the balloon.
7. Pull the skewer through and out. The holes will close and hardly any air will escape – you've made an unpopable balloon!

Wrap-Up/Debrief

- Doing this experiment is the same as poking your finger into a bowl of cooked spaghetti – the individual noodles are not disrupted or broken, rather, the spaghetti noodles as a group are pushed out of the way by your finger, making room for it. The same happened with the skewer being pushed into a dense group of rubber molecules!
- Briefly discuss the term tension. Because the skewer is inserted into points on the balloon where the rubber is denser (and where tension is lower), the balloon does not pop. The molecules in these spots are more densely packed together, and less stretched out compared to the rest of the balloon. The surface that is not experiencing a great amount of tension is able to handle more stress, such as a skewer poking it.

Additional Resources

- <http://pbskids.org/designsquad/build/unpopable-balloon/>