SICK! science®
insanely cool experiences

BALLOON SKEWER

EXPERIMENT GUIDE

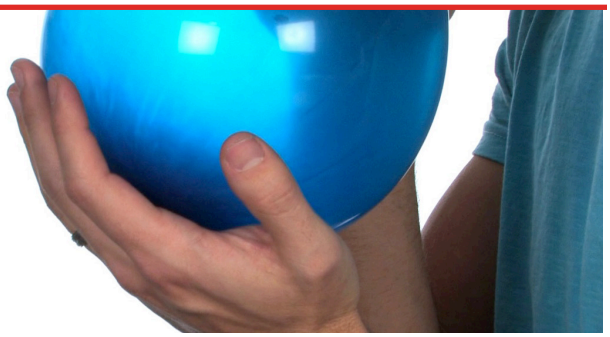
BALLOON SKEWER

Some things in this world just don't mix—dogs and cats, oil and water, needles and balloons. Everyone knows that a balloon's worst fear is a sharp object . . . even a sharpened wooden cooking skewer. With a little scientific knowledge about polymers however, you'll be able to perform a seemingly impossible task—pierce a balloon with a wooden skewer without popping it. Suddenly piercing takes on a whole new meaning!

WHAT YOU NEED

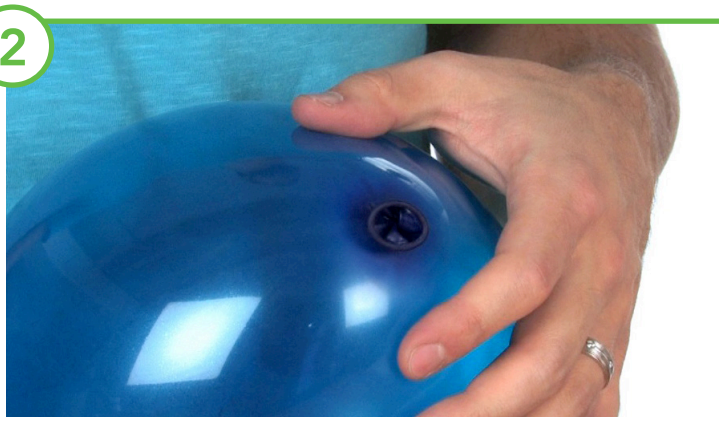
- LATEX BALLOON
- BAMBOO COOKING SKEWER
- COOKING OIL OR DISH SOAP

1



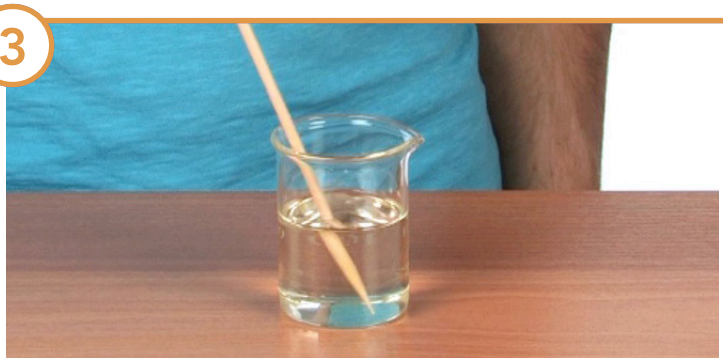
Blow up the balloon about 75% full.

2



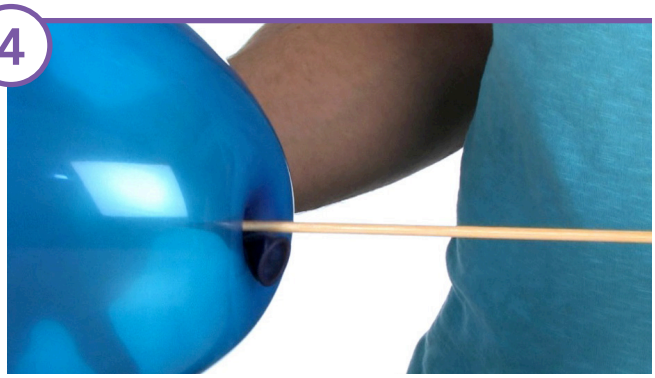
Tie off the end of the balloon.

3



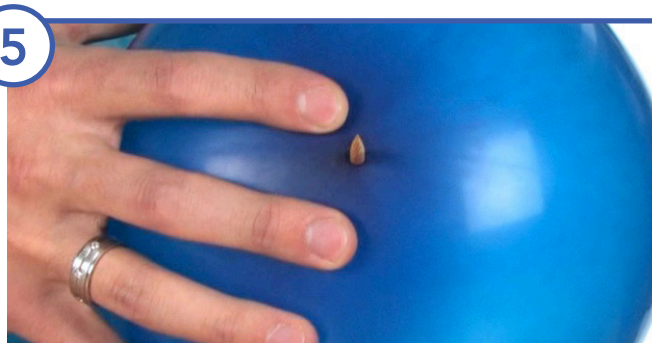
Apply a thin layer of oil to the skewer.

4



Gently twist the skewer into the ballon next to the knot.

5



Exit the balloon with the skewer on the side opposite of the knot where the balloon is the darkest color.

HOW DOES IT WORK

The secret of this trick is to use the portion of the balloon where the latex molecules are under the least amount of stress or strain. If you could see the latex that makes up a balloon on a microscopic level, you would see many long strands or chains of molecules. These long strands of molecules are called polymers, and the elasticity of these polymer chains causes latex to stretch. Blowing up the balloon stretches these strands of polymer chains.

You wisely chose to pierce the balloon at a point where the polymer molecules were stretched out the least, the ends of the balloon. The long strands of molecules stretched around the skewer and kept the air inside the balloon from rushing out. The oil or dish soap provided some lubrication, allowing the skewer to slide smoothly into the balloon without additional friction or stress on the molecules. When you removed the skewer, you felt the air leaking out through the holes where the polymer strands were pushed apart. Eventually the balloon deflated, but it never popped, right?

Trying to pierce the balloon in the middle section is nearly impossible unless you have some help from a piece of clear tape. Normally, the long chains of latex molecules are under so much stress or tension that they tear easily with the slightest puncture. The clear tape helps to hold the latex molecules in place, preventing them from tearing apart when the balloon is punctured. In an attempt to fool the people who know how to push a skewer through the ends of a balloon, magicians will secretly place pieces of clear tape in the middle section of a balloon to keep the balloon from popping when they puncture the balloon in this "forbidden" area. It's just another way to make even the smartest people say, "How did you do that?"

Aside from learning about the science of polymers, the Balloon Skewer activity can be used as a great way to demonstrate a life lesson on how to approach a potentially stressful situation. The key to approaching any stressful situation is to find the area of least stress and to use this as an entry point as you attempt to relieve the tension. In other words, every stressful situation has a "best point of entry" and requires a good exit strategy if you are going to be successful in diffusing the potentially volatile situation. It's a great object lesson at any age!

TAKE IT FURTHER

To make the stress on the polymers more visible to students, draw dots of the same size all over the uninflated balloon. When you inflate the balloon, point out how much larger the dots in the middle of the balloon are than the dots at the end. This is because the polymer chains are being stretched more, increasing the level of stress and sensitivity in the middle of the balloon. You will also notice that the dots on either end of the balloon are relatively small in comparison to the enlarged dots in the middle section of the balloon. You've just uncovered the area of least stress—the ends of the balloon.

Pushing a skewer through the ends of the balloon is a challenging task, but attempting the same thing in the middle of the balloon is impossible . . . unless you have a few pieces of clear tape. Blow up a new balloon and place a small piece of clear tape in the middle of the balloon. Position the sharpened point of the skewer in the middle of the tape and carefully push the end of the skewer into the balloon without popping it! Try it again, but this time use a straight pin or the sharpened end of a safety pin. What role does the tape play in keeping the balloon from popping?

SCIENCE FAIR CONNECTION

While puncturing a balloon with a skewer leaves the audience in awe, it is not a science fair project. You can create a science fair project by identifying a variable, or something that you can change, in this experiment. Let's take a look at some of the variable options that might work:

- Try different sizes of balloons or skewers. Do certain sizes puncture more easily than others?
- Try different brands of balloons. Do some brands allow you to get further away from the ends than others?

These are just a couple of ideas, but you aren't limited to them! Come up with different ideas of variables to test and give them a try. Remember, you can only change one variable at a time for each test. For example, if you are testing different balloon sizes, make sure that all other factors in the test remain the same!

TEACHER NOTES:

SCIENCE CONCEPTS OVERVIEW ▸ Molecules, Polymers

The learning experiences contained in the following Experiment Guide are designed to engage students and deepen understanding, not only of the underlying scientific concepts upon which these experiments/demonstrations are built, but also of critical thinking and problem solving skills. Teachers should allow students to actively participate in each activity as an investigation, where questions are being asked, hypotheses are developed and redeveloped, and where students own the discoveries. Vocabulary was included, assessments were created and critical thinking questions were designed with this underlying goal in mind.

The following are some suggested teaching points that could accompany this experiment/demonstration:

SICK Science Teaching Points: The SICK Science video can be utilized in a variety of ways. It can be used to introduce a scientific concept or in place of doing the demonstration/experiment if materials are unavailable. The video can also be used as a review or to help students complete the various learning experiences included in this guide. The video can also be used as a review or to help students complete the various learning experiences included in this guide.

Visit the landing page below to locate the appropriate video for this activity
stevespangler.com/sick-science-resources

Vocabulary: Students will enhance their science-content related vocabulary. You may choose to introduce the vocabulary words and explicitly teach the meaning of each. You may also use the vocabulary words as an investigation, where students may research the meanings of the words. Finally, students may develop their own meaning for each word through their experience with the experiments and critical thinking work.

Scientific Method: Students can complete a full lab report for the demonstration, including asking questions, identifying variables, forming a hypothesis, designing the experiment, collecting data, and drawing conclusions. Differentiation using the lab report is easy. For lower levels, complete the lab report as a class. As students are more independent, encourage students to work in partnerships or groups to complete the lab report. Eventually, students should be able to complete the lab report independently or design a new experiment using the lab report form based on the demonstration completed in class.

Identify Details - Students will identify the relevant details of the balloon where the skewer enters and exits.

Summarize - Students will create a summary that includes the important ideas and details of the skewer entering the balloon.

Generalize - Students will relate knowledge gained from the experiment/demonstration to other concepts such as other latex products.

Literature Connections: The Blue Balloon by Mick Inkpen is a fantastic read aloud to get students engaged in the idea of an indestructible balloon. After reading, use the Balloon Skewer activity to demonstrate your own indestructible balloon.

Writing Connections: Students can practice procedural writing by correctly sequencing the steps in the SICK Science video. They should add clarifying details and diagrams when necessary. Older students should also use transition words or phrases.

Expert Vocabulary

NAME _____

WORDS AND DEFINITIONS —
Match the word on the left with the correct definition on the right by filling in the blank with the correct letter.

VOCABULARY WORDS	DEFINITIONS
1 ____ **Polymer**	A A stretchy, rubber-like substance derived from plants.
2 ____ **Molecule**	B Pressure or tension placed on an object.
3 ____ **Stress**	C A chemical compound formed from a long chain of the same molecule group.
4 ____ **Latex**	D To make a surface smooth or slippery.
5 ____ **Lubrication**	E A group of two or more atoms that stick together.

Critical Thinking

NAME

IDENTIFY DETAILS —
Students will identify the relevant details of the balloon where the skewer enters and exits.

Draw or explain what the balloon looks like and feels like on the ends where the skewer enters and exits. How are the ends different than the middle of the balloon?

Critical Thinking

NAME

SUMMARIZE —
Students will create a summary that includes the important ideas and details of the skewer entering the balloon.

In your own words, explain what is happening at a molecular level as the skewer enters and exits the balloon without popping it. Include a labeled diagram to clarify your thinking.

Critical Thinking

NAME

GENERALIZE —
Students will relate knowledge gained from the experiment/demonstration to other concepts such as other latex products.

In addition to making balloons, latex is also used to make gloves. If you were to blow up a medical glove and try to put a skewer through it without popping it, explain the procedure that you would use and why. Then, try it out!

Assessment

NAME _____

ASSESSMENT QUESTIONS —
Read each question, then circle the letter next to the correct answer or write your response on the back of this page or in the box.

1. The balloon is made out of a material called...
   a. plastic
   b. latex
   c. sap
   d. rubber

2. The oil on the skewer provides...
   a. heat.
   b. friction.
   c. expansion.
   d. lubrication.

3. When the polymers in the balloon are stretched thin, they _____.
   a. are a lighter color
   b. break easily
   c. are more transparent
   d. all of the above

4. On the back of this page, draw a labeled diagram of the skewer going through the balloon. Include a close-up of what the polymers around the skewer may look like.

5. Why is it important to lubricate the skewer with oil or soap before inserting it into the balloon?

_____

_____

_____

_____

Expert Vocabulary - Answer Key

WORDS AND DEFINITIONS —
Match the word on the left with the correct definition on the right by filling in the blank with the correct letter.

	VOCABULARY WORDS		DEFINITIONS
1	C Polymer	A	A stretchy, rubber-like substance derived from plants.
2	E Molecule	B	Pressure or tension placed on an object.
3	B Stress	C	A chemical compound formed from a long chain of the same molecule group.
4	A Latex	D	To make a surface smooth or slippery.
5	D Lubrication	E	A group of two or more atoms that stick together.

Critical Thinking- Answer Key

IDENTIFY DETAILS —
Students will identify the relevant details of the balloon where the skewer enters and exits.

Draw or explain what the balloon looks like and feels like on the ends where the skewer enters and exits. How are the ends different than the middle of the balloon?

Possible Answer:
The balloon is a darker color on the ends where the skewer enters and exits. It also feels thicker and more rubbery because the polymers are bunched together. The middle of the balloon is a lighter color and looks very thin because the polymers are stretched apart.

Critical Thinking- Answer Key

SUMMARIZE —
Students will create a summary that includes the important ideas and details of the skewer entering the balloon.

In your own words, explain what is happening at a molecular level as the skewer enters and exits the balloon without popping it. Include a labeled diagram to clarify your thinking.

Possible Answer:
When the skewer enters the balloon on the end next to the knot, the polymer chains in the latex are thick enough that they are able to create a seal around the skewer and keep the air trapped inside of the balloon. The balloon does not pop because the polymers are not stretched thin like they are in the middle part of the balloon.

Critical Thinking- Answer Key

SUMMARIZE —
Students will create a summary that includes the important ideas and details of the skewer entering the balloon.

In your own words, explain what is happening at a molecular level as the skewer enters and exits the balloon without popping it. Include a labeled diagram to clarify your thinking.

Possible Answer:
If I were to try and duplicate the Balloon Skewer activity with a latex glove, I would start by blowing up the glove and tying a knot. I would lubricate the skewer with oil or soap and I would insert the skewer at the bottom of the glove near the knot. I hypothesize that this would be an area with less stress and thicker polymers, keeping the glove from popping. I think that the fingertips of the glove would also be thicker so I would exit the skewer through one of the fingertips.

Assessment - Answer Key

ASSESSMENT QUESTIONS —
Read each question, then circle the letter next to the correct answer or write your response in the boxes.

1. The balloon is made out of a material called...
   a. plastic
   b. latex
   c. sap
   d. rubber

2. The oil on the skewer provides...
   a. heat.
   b. friction.
   c. expansion.
   d. lubrication.

3. When the polymers in the balloon are stretched thin, they...
   a. are a lighter color.
   b. break easily.
   c. are more transparent.
   d. all of the above.

4. On the back of this page, draw a labeled diagram of the skewer going through the balloon. Include a close-up of what the polymers around the skewer may look like.
   Possible Answer:
   The diagram should include the polymers split apart with the skewer through the center. The polymers then create a seal around the skewer to keep the air in the balloon.

5. Why is it important to lubricate the skewer with oil or soap before inserting it into the balloon?

   Possible Answer:
   It is important to lubricate the skewer before inserting it into the balloon because otherwise the skewer may cause too much friction entering the balloon which may tear a larger hole or even cause the balloon to pop.

Common Core State Standards

Student Outcomes	Standards
Students will be able to ask and answer questions about key details about their observations and discussion to demonstrate their understanding of the scientific concepts presented through the experiment.	RI.K.1, RI.1.1, RI.2.1, RI.3.1, RI.4.1
Students will be able to ask and answer questions to help determine the meaning of vocabulary presented as part of an experiment.	RI.K.4, RI.1.4, RI.2.4, RI.3.4, RI.4.4, RI.5.4
Students will be able to explain the connection between scientific ideas presented in the experiment.	RI.1.3, RI.2.3, RI.3.3, RI.4.3, RI.5.3
Students will be able to retell key details presented in the experiment in order to understand/determine the main idea.	RI.K.2, RI.1.2, RI.2.2, RI.3.2, RI.4.2, RI.5.2
Students will be able to participate in writing projects and write a sequence of instructions.	W.1.7, W.2.7
Explain the procedure and ideas presented in a scientific experiment including what happened and why, including cause and effect, based on the information presented.	RI.3.3, RI.4.3
Students will be able to recall information from experiences to answer a question.	W.K.8, W.1.8, W.2.8