

**Lesson: Science, Grades 2-3**  
**Topic: Suspension**



# Suspend It!

## Overview

Wouldn't a heavy object, like a witch, hurt when hanging onto your hair? How much weight could your hair hold before breaking? Students will work in cooperative groups to conduct an investigation in which they "test" the strength of "hair" when lifting and holding a given amount of mass. Group presentations, discussions, and comparisons of data lead to predictions, inferences, and evaluations of the task and collected data.

## Learning Outcomes

### National Standards:

#### Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

#### Physical Science

- Properties of objects and materials
- Position and motion of objects

#### Science and Technology

- Abilities of technical design

### Ohio Standards:

#### Physical Science

Students demonstrate an understanding of the composition of physical systems and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes demonstrating an understanding of the structure and properties of matter, the properties of materials and objects, chemical reactions and the conservation of matter. In addition, it includes understanding the nature, transfer and conservation of energy; motion and the forces affecting motion; and the nature of waves and interactions of matter and energy. Students demonstrate an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with the physical sciences.

## Materials

- Stopwatch
- Measuring tape
- Camera (could be digital with a printer or immediate use)
- Yarn, multiple strengths cut to given length for each group (Test the yarn before giving it to the student to determine its breaking point and exactly how much to give them to use for the activity. Different yarns have different capacities for this type of activity.)
- 2 bricks per group, or another object similar in weight and size
- Chart paper
- Markers
- Picture of the group "test" for each student in that group

## Technology

Take digital camera pictures of each group as they conduct their test. Print the pictures so that captions can be added later by the group.

## Vocabulary

- Suspend
- Force
- Pull
- Push
- Contact
- Non contact forces

## Lesson

NOTE: This lesson begins as a demonstration and then follows with groups conducting their own investigation and presentation. Some prior experience in this type of activity is essential, or time must be spent now in the instruction of appropriate conduct of the group during the investigation.

### *Orientation activity:*

\*\*Select yarn that will break when conducting the demonstration.

\*\*Use metric measurement if your students have been introduced to centimeters.

1. Refer to the production and how Rapunzel must have felt when someone climbed her hair. Ask students to describe what they believe it would be like to have that mass on their own hair. Discuss the strength that must have been in Rapunzel's hair and how the hook helped relieve the pressure on her head.
2. Demonstrate the following as you explain the group activity for the day. Attach the yarn to the bricks in a way that you have tested earlier and know will cause the yarn to break. (This will depend upon the yarn you select and the way that you attach it to the brick.)
3. The "test" is to attach the yarn to the brick so that you can raise it at least 6 inches off of the ground and hold it there for 30 seconds without the yarn breaking or the brick falling out of the yarn. Have students predict what will happen when you conduct your test. Ask them to explain their prediction, what they based it upon.
4. Conduct the "test". When the yarn breaks, ask the students to evaluate what you did and why you believe it broke. Multiple answers may be shared. Record all on chart paper. Ask students for suggestions that might help your "test" be more successful. Record on the chart paper any recommendations made by the students.

### *Learning activity*

1. Divide students into cooperative groups. Hand out instructions sheet with the steps for the investigation. Read through the instructions with the class pointing out that they are to be used as a checklist as the group completes each step. Also note the statements that everyone is to participate. This will build on cooperative group work. As students work, monitor the conversations and progress. If needed, step in and ask group members to explain what they are doing and why. Check that all members are actively engaged in the work of the group. Ask how they use the data from the demonstration to help guide their work. (If you are ready to include variables in the group work, use multiple strengths of yarn, different for a couple groups. This might even include the same yarn used during the demonstration to determine if the attachment method might make a difference in the results.) These questions will guide you to additional questions and observations of the students.

2. Provide adequate time for the groups to develop a solution to the problem. It is best to not provide time for a trial test so that the investigation is based solely upon the use of observations and recommendations from the demonstration.
3. Presentations! As each group makes their “test”, record it with a camera (35mm or digital). Applause from the class for each group “no matter what” results.

## Handouts

- Group instruction sheet

## Evaluation and Follow-Up

### Assessment tools and methods

-Display the picture of the group test for each student in the group. If using digital pictures, print with space for written/typed comments below the picture. If using 35 mm pictures, attach the picture to paper for comments. You may need to elaborate and/or review terminology that is used in the questions based upon your students’ knowledge of physical science. The group discusses the following questions:

What did your group do to prepare for this test?

What could you have done differently now that you know the results?

What actually happened during the test? How did the results surprise you?

What forces were acting upon the object when it was suspended?

(Introduce the terms contact and non-contact forces if needed at this time as the students identify the forces.)

How do we know what forces were involved during the “test”?

What do you predict would happen if we applied another force on the object?

What types of forces could we apply that might change the results of the “test”?

How did you prepare for the affects of these forces? If you didn’t, what would you do if you did it again to prepare for these affects?

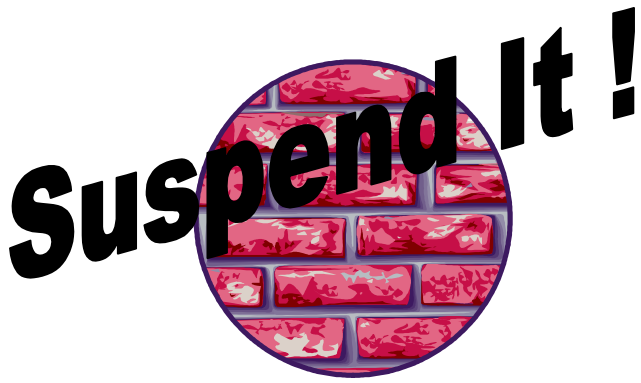
-Following the group discussion, each student writes a summary of the investigation on their page with the picture of the test. Scribe for students if necessary. Include labels on the diagram or arrows pointing to key points from the picture. The summary should include the individual student’s role in the preparation and testing, what surprised them the most about the test, and what they would do differently if conducting the same investigation again. What did your group do to be successful in working together and what could you have done better? Use this evaluation to check student understanding of the investigation and data it produced. Also use this to determine the effectiveness of the group.

### Interdisciplinary connections

Math- Make predictions and then test them with a variety of objects with different masses and/or different lengths of yarn, time or distance from the ground. Compare the results to draw a conclusion about how these variables change the data.

Language Arts-Use the written explanations to evaluate non-fiction writing skills. Combine the written descriptions into a class book about the experience.

# Suspend It!



Your problem for today:

Use the bricks and yarn.  
Attach the yarn to the bricks so that together they can be suspended at least 6 inches above the table/ ground and hold them there for at least 30 seconds.

**Put a checkmark in the box by each step as you finish it. This paper will be collected later.**

- Share your ideas with the group as to how you think you should solve today's problem. Everyone has a chance to share.
- After hearing all ideas, everyone tells what he/she thinks is the best solution. Decide which solution your group will use.
- Prepare for the "test" so that your brick will be suspended at least 6 inches above the table/ ground and stay there for at least 30 seconds. Everyone helps put it together.
- Prepare to present and "test" your idea. Everyone takes an active part. Decide who will conduct the "test" and who will explain how and why your group did it that way.
- Work quietly on other assigned work until it is time for presentations.