

Think Tube

Introduction

What was it like to imagine the nature of the atom? How difficult is it to produce a model of something that can't be seen? The Think Tube allows students to appreciate the challenges associated with understanding things we can't see, such as atoms. As the instructor performs a series of simple manipulations with the Think Tube, students record their observations and later develop their hypotheses.

Concepts

- Models
- Hypothesis

Materials

Cords, nylon, 36", 2

Mailing tube, 18" long, 1.5" in diameter, with with end caps

Markers, permanent, red, green, blue, yellow

Washer, 3/4-inch diameter

Wood beads, 3/4-inch diameter, drilled, 4

Safety Precautions

The Think Tube is considered nonhazardous. Follow all normal laboratory guidelines.

Preparation

1. Color each wood bead a different color with permanent marker or paint.
2. Drill four holes through the mailing tube 3/4" away from the ends (see Figure 1).
3. Loop the cords through a washer as shown in Figure 1. Place the washer in the middle of the tube.
4. Pull the ends of the cords through the holes of the tube (see Figure 1).
5. Pull the ends of the cords through the holes of the wooden beads and tie a knot at the end of the cords to hold the beads in place. Use the red bead in the upper left position, the yellow bead in the lower left position, the blue bead in the upper right position and the green bead in the lower right position (see Figure 1).
6. Cover the ends of the tube with the tube caps.

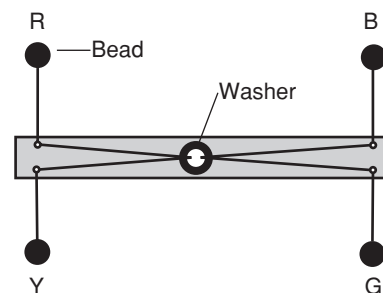


Figure 1.

Procedure

1. Have students make a worksheet with three columns.
2. Have students draw the original positions of the beads for each demonstration in the first column.
3. The basic sketch for each manipulation should look similar the Figure 2. (R = Red bead; B = Blue bead; Y = Yellow bead; and G = Green bead)
4. In the middle column of the Think Tube Worksheet, students should draw or write what happened in each demonstration. 5. In the right column of the Think Tube Worksheet, students should draw or write their hypothetical explanation for each demonstration.
5. Perform the following three demonstrations. Be sure to pull the cord until it stops.

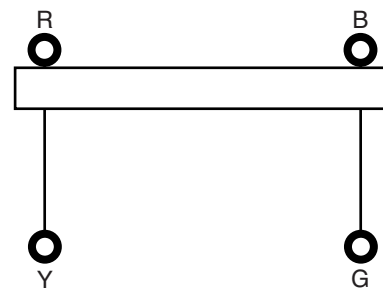
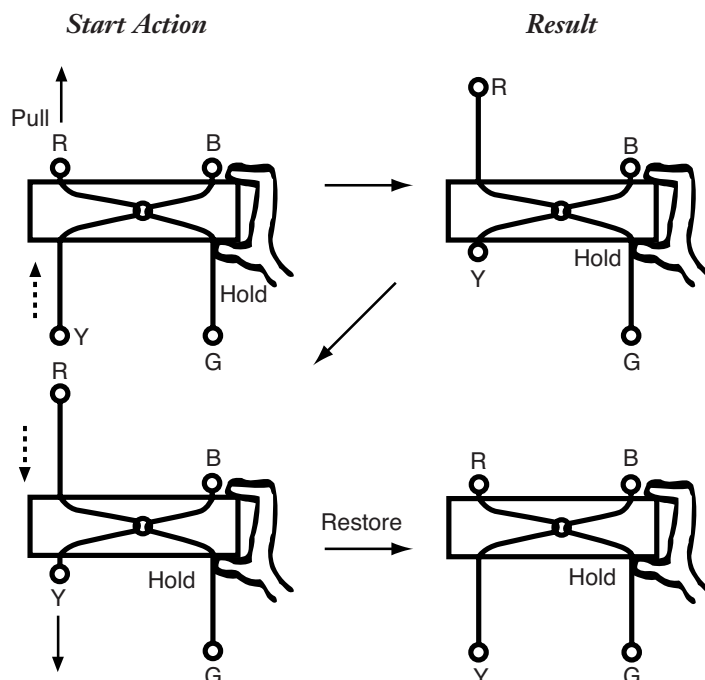


Figure 2.

Demonstration 1

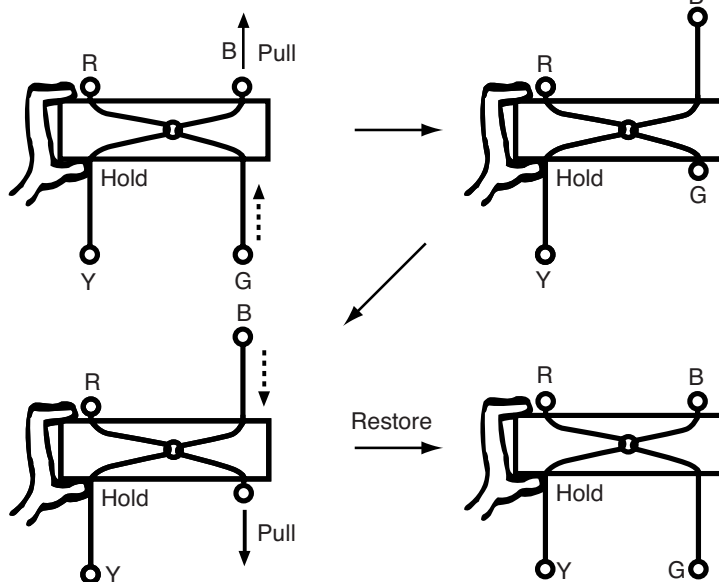
Red and yellow beads on left end appear to be connected by a single string.

1. Hold the cord attached to the green bead.
2. Pull the red bead up.
3. Pull the yellow bead down.



Blue and green beads on right end appear to be connected by a single string.

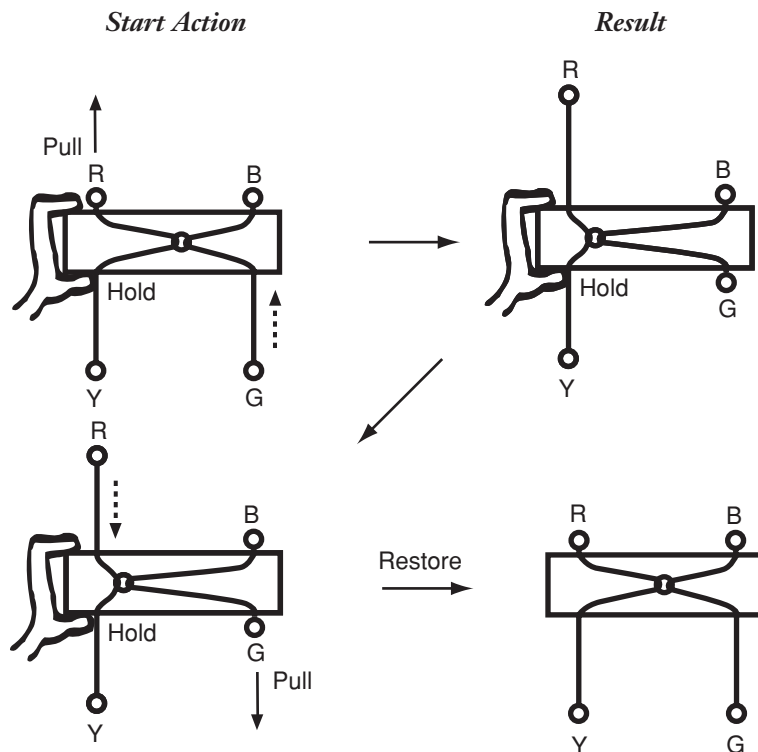
1. Hold the cord attached to the yellow bead.
2. Pull the blue bead up.
3. Pull the green bead down.



Demonstration 2

Red and green beads appear to be connected by a single string.

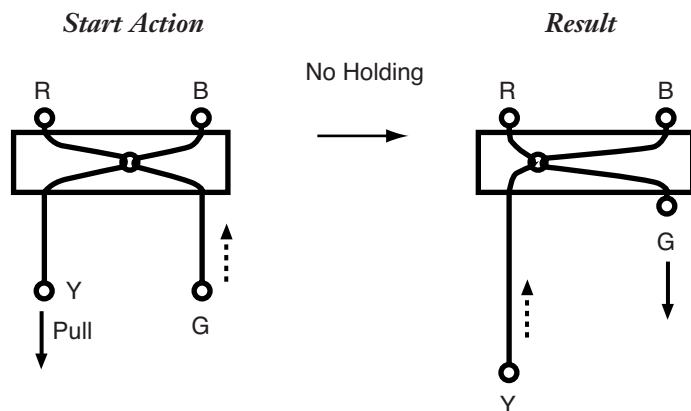
1. Hold the cord attached to the yellow bead.
2. Pull the red bead up.
3. Pull the green bead down.



Demonstration 3

Yellow and green beads appear to be connected.

1. Hold no cords.
2. Pull the yellow bead down.
3. Pull the green bead down.



Review

Repeat any and all demonstrations and review what was observed.

Review should show that:

Demo 1: The red and yellow beads appear connected and the blue and green beads also appear connected.

Demo 2: The red and green beads appear connected.

Demo 3: The yellow and green beads appear connected.

So, it is pretty clear by now that the top and bottom strings on each end are not one single string.

Disposal

The Think Tube may be reused from class to class and year to year.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

Content Standards: Grades 5–8

Content Standard A: Science as Inquiry

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry

Tips

- This demonstration may be done as many times as desired.
- Practice each step of all four demonstrations before presenting the entire activity to the students. Some practice will be required to master all of the steps, especially holding the string at the holes without being obvious to students.
- A nylon cord works best. Regular string may eventually fray and break.
- The ends of the cords may be melted with the flame from a match to prevent fraying.

Discussion

The demonstrations presented in this activity are designed to create discrepancies in the minds of the viewers. In the first demonstration, it appears that the red and the yellow beads are directly connected together and that the blue and green beads are connected. In the second demonstration, the red and green beads seem to be attached to each other. The third demonstration seemingly illustrates that the yellow and green beads are also attached. Repeat the three demonstrations as many time as necessary for your students to develop a model. Some students may be able to describe in words better than draw what is occurring. Encourage both words and drawings to record observations and the model.

The goal of this demonstration is to have students hypothesize and develop a possible model of exactly what is happening. The demonstration may be presented as many times as you would like until students fully understand the mechanics behind the Think Tube. You may want to reveal the design at the end of the demonstration, or you may decide to keep the secret to yourself. Use your discretion!

Acknowledgment

Special thanks to Robert Lewis, Downers Grove North High School, Downers Grove, IL, and Jeff Hepburn, Dowling High School, West Des Moines, IA, for providing the idea and instructions for this activity.

Materials for *Think Tube* are available from Flinn Scientific, Inc.

This activity is also available as a teacher demonstration kit.

Catalog No.	Description
AP5815	Wood Balls, $\frac{3}{4}$ ", Drilled
AP6149	Think Tube Demonstration Kit

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.