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CH151 2016

## **Structures**

### Teacher's Instructions

**ACTIVITY:** Students will explore the relative strength of shapes to determine which is the strongest and able to hold the most books/magazines/notebooks effectively.

### **LEARNING GOALS**

- Students will test the strengths of different shapes.
- Students will observe the amazing ability the unlikely shapes (round, triangular) have to bear weight.
- Students will understand the best building methods and will be able to identify them in the world around them.

**RECOMMENDED GRADES:** 2-8

### **MATERIALS NEEDED**

Consumable: 9 latex balloons, 4 small marshmallows per group, 2 large marshmallows per group, 1/3 box of uncooked spaghetti per group, three sheets of computer paper

Non-Consumable: strong piece of cardboard (sturdy enough to be stood on), books/notebooks/magazines or other similar objects

**ESTIMATED COST:** Approx. \$30

**SAFETY INFORMATION:** The balloon activity is most interesting if a student stands on top. They must stand to keep the weight properly distributed but this is an uneven and wobbly surface. Utilize proper supervision by multiple adults.

### **APPROXIMATE TIME:**

Preparation: 10 minutes to blow up balloons or to make tube shapes.

Activity run-time: 30 minutes and up. Students can always go back and improve their structure design to make it stronger. As a result, the activity can run for as long as needed.

### **PROCEDURE:**

1. Standing on Air: Inflate 9 latex balloons and attach them to the bottom of a strong and sturdy piece of cardboard. Pile on heavy books or other objects to demonstrate strength of balloons. Finally, allow a student to stand on top (under close supervision). One by one, pop the balloons, leaving the center balloon for last. The last two balloons should (surprisingly) hold the weight of the student without popping.

Summary: Because the strain on the balloons is applied evenly and is not applied quickly, the balloons can hold a surprising amount of weight.

2. ALTERNATIVE FOR LATEX FREE LOCATIONS: fold three pieces of paper into a square tube, a triangle tube, and a circular tube. Test which tube can hold the most magazines/books/notebooks on top before collapsing.

Summary: The circular tube will be able to hold the most notebooks. The weight from the notebooks is distributed evenly around the edge of the circular paper. The square and triangular tubes hold the weight of the notebooks on rests on the corners of the tubes which provide less area for the weight of the notebooks to be distributed.

3. Divide the students into teams (at most) two. Providing them with two large marshmallows, four small marshmallows, and approximately 1/3 a box of uncooked spaghetti, each team will build a structure and place a plastic cup on top. They will then drop coins into the cup to test the strength of their structure. Discuss which shapes were most effective (triangles being the likely winners).

Summary: Shorter pieces of spaghetti and triangular shapes will hold the most notebooks. Triangles allow for the distribution of pressure to be spread without losing shape.

Worksheet: Below is a worksheet suitable for any grade.

Name: \_\_\_\_\_

1. What shape is the strongest? \_\_\_\_\_

2. *Predict*: How many balloons can you stand on?

\_\_\_\_\_

3. Use the space below to plan out your structure:

4. How many coins could your structure hold?

\_\_\_\_\_