

AT-HOME SCIENCE

Paper Strength

Learning about engineering

Do you think a single sheet of paper can hold up a book? What about 5 books or even 10, 20, or 30 books? When we think about paper, we may think about how easy it is to tear it, crumple it, and bend it without much effort or strength.

In this At-Home Science experiment, you will learn about the strength of various geometric shapes by testing how much weight different shaped paper columns can hold. The activity can be expanded upon with a little creativity.

Can you think of other ways to support the weight of books using just a single sheet of paper? Does changing the type of paper affect the results? Use this protocol as inspiration to test some designs and find solutions to a complex problem.

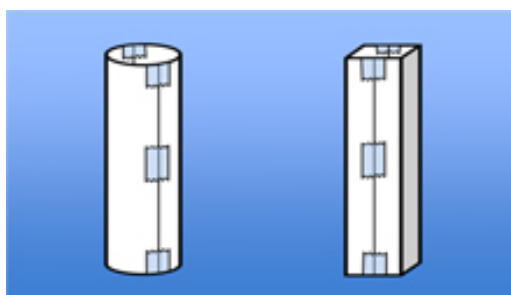
Materials

- About 30 small children's books
- 5-6 sheets of 8.5 x 11 paper
- Scotch tape
- Loose-leaf paper
- Cardstock

Protocol

PART ONE: making paper columns:

1. Roll or fold your sheets of paper long-ways to form columns in the shape of a triangle, square, and circle.
2. Use a few pieces of tape to join the ends of the paper so that the column maintains its shape on its own.
3. Test the strength of each shape by slowly placing books, one at a time, on top of a column.
4. Note how many books each column was able to support before crumbling.

**PART TWO: expanding on what you have learned:**

5. Repeat the test with sheets of loose-leaf paper and cardstock, how do the results compare?
6. Try molding the paper into other new, unique shapes.
7. Repeat the book stacking test and note how many books each shape is able to support before crumbling.
8. Get creative with your designs!

Observation

CONTENT AREA(S)

Engineering, Physics, Geometry

Questions to ask

- What shape was the strongest?
- Why do you think that shape was the strongest?
- What would happen if you used different paper?
- What other solutions in the kitchen could you test?
- Have you noticed columns in buildings and other structures in the neighborhoods around you?
- What other ways could you shape paper to support the weight of books?

DATA COLLECTION POWER UP

Sketch your observations

-or-

Draw a data table to keep track of the changes you observe

Why did this happen?

The square and triangle break down more easily because they shift all of the weight of the books to their edges and corners. This causes their walls to deform and leads to a quick collapse because the edges can't support the **load**. The circle-shaped column, known in geometry as a **cylinder**, can support the most books because its walls don't have any **edges**. This means the load or weight of the books is distributed evenly and cannot become concentrated in a particular area. So, all parts of the cylinder are sharing the load of the books equally.