

**Topics**

Forces, Engineering, Design

**Materials**

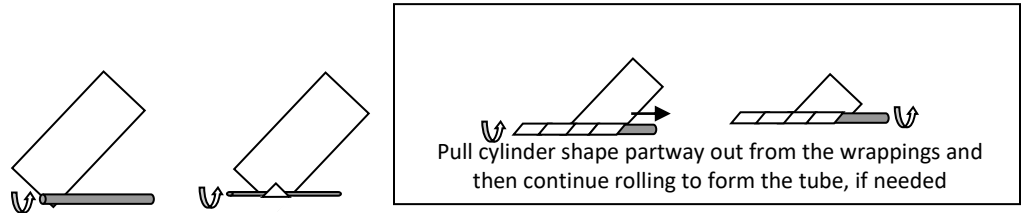
- ✓ Paper, multiple rectangular sheets of identical size
- ✓ Cylindrical object (wood dowel, straw, or equivalent)
- ✓ Tape or adhesive
- ✓ Scissors
- ✓ Smooth flat surface

**Learning Standards**

NGSS: Physical Science, Forces & Motion; Engineering, Compare Multiple Solutions, Test Variables & Design Criteria

# Wrap It Up!

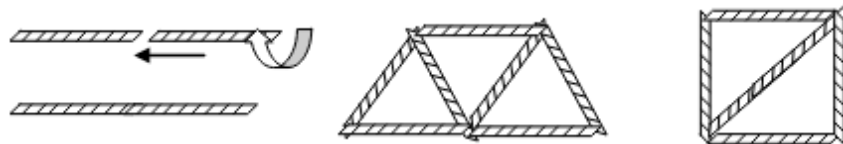
Creating Paper Tubes for a Variety of Purposes



A simple technique can be used to turn thin paper into surprisingly strong tubes.

**To Do and Notice**

1. Assembly: Place a sheet of the paper at a 45° angle on a smooth flat surface. Use one of the 2 wrapping techniques shown above (left) to roll the paper tightly around a cylindrical item.
2. If the sheet of paper is longer than the length of the cylindrical item, continue rolling or pull the cylindrical item partway out from the partial formed tube and then continue rolling up the paper, repeating as necessary.
3. Use tape or adhesive labels to secure the upper corner of the paper to the side of the tube to keep the wrapped paper from unraveling.
4. To make a longer tube, insert a single tube into the wider opening of another wrapped tube and twist together until tight and/or tape tubes together.
5. Note: Stronger tubes can be made by laying and rolling multiple layers of paper.
6. Design Challenge: Use the wrapped paper tubes to build a bridge, make a tower, or other interesting structure that can hold a noticeable amount of weight, demonstrating how strong paper can be when rolled up (see below for ideas).
7. Optional: Decorate the paper tubes with color or extra art materials.



**The Content Behind the Activity**

Thin flexible material, such as sheets of paper, can become a stronger building element when formed into a cylinder. Wrapping thin material in a spiral, as seen in some exposed inner tree fibers, will make for an even stronger tube. Thin sheets of paper bend and buckle when weighed down with heavy objects. Paper is not strong in the thin direction. Folding or rolling the paper creates a thicker combined layer of material, so the paper reinforces itself. Making structures with these self-reinforced paper “beams” results in being able to support more weight, which leads to more interesting investigations!

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