

# NEWSPAPER TENTS

**AT A GLANCE** Students become engineers as they build a tent from newspapers and learn what shapes make structures strong.

## OBJECTIVES:

Students will:

- Learn how shapes help determine the structural integrity of a structure.
- Work as a team to build a successful structure.

## KEY VOCABULARY

Civil Engineer

## NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Obtaining, evaluating and communicating information

## CROSCUTTING CONCEPTS

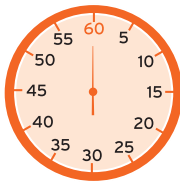
- Patterns
- Scale, proportion and quantity
- Structure and function

## DISCIPLINARY CORE IDEAS

- ETS1: Engineering design
- ETS 2: Links among engineering, technology, science and society

## PACE YOURSELF:

\* 60 minutes



## ADVANCE PREPARATION

1. Tell students in advance to bring in old newspapers (about two full papers per student).
2. Determine how you will divide students into groups of three or four.
3. Create a triangle and a square out of rolled up sheets of newspapers (see Warm Up).



## MATERIALS

Per group:

- Lots of newspaper (about two full papers per student)
- Masking tape or duct tape
- Stapler
- Pipe cleaners
- Craft sticks (optional)



## WHAT YOU NEED TO KNOW

Triangles are the strongest shape. Even under enormous pressure from forces, such as tension and compression, triangles keep their shape. This is why **civil engineers**, people who design structures such as roads, bridges and skyscrapers, and supervise their construction and inspection, often use them in buildings and other construction projects that need to withstand a lot of force.

One of the most common uses of triangles is in the frame of buildings. Look at a building construction site and you will see triangles all over the place. The John Hancock Center in Chicago is a great example of a triangle frame; you can see the triangles on the outside of the building. Triangles are also used in certain types of bridges, called truss bridges. These bridges are made out of inter-connecting triangles and they are able to support a lot of weight. An example of a triangle design from ancient times is the pyramid, such as the Great Pyramid at Giza. The pyramid shape is made out numerous blocks that are stacked in a way to form triangle sides. These pyramids have remained standing strong after thousands of years.



## WARM UP

1. Use rolled up newspaper sheets to create an equilateral triangle and a square. Create each one using two sheets of flat newspaper. Use open, two-page spreads, not single sheets. Roll them tightly from corner to corner — the tighter the roll, the stronger the support. Secure the ends with tape. Ask students which shape is stronger, and why.
2. Demonstrate that the triangle is stronger by applying a small amount of force to each shape. Triangles are the strongest shape because any force applied is spread evenly through all three sides.
3. Show students pictures of triangles in structures, such as bridges, skyscrapers, ceilings and radio towers.

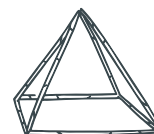


## ACTIVITY

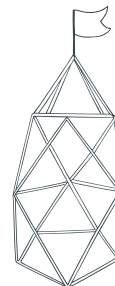
1. Tell students they will create tents using newspapers.
2. Divide students into groups of three or four.
3. Have each group create 37 newspaper rolls. They will create each one using two sheets of flat newspaper. Use open, two-page spreads, not single sheets. Roll them tightly from corner to corner — the tighter the roll, the stronger the support. Secure the ends with tape.
4. Each group will then use their newspaper rolls to create 11 triangles. They will attach corners together with staples. Note: The last four newspaper rolls will be used to brace their tent.
5. Have them prepare the base of their tent by laying five triangles flat on the ground so that a side of each triangle forms a line. Have them attach the triangles to together along the bottom edge with staples and/or tape. Have them prepare the middle layer by attaching four triangles to each other in the same way.



6. Instruct the students to make a pyramid for the top by attaching the last two triangles at their tops, opposite each other, and using two straight newspaper rolls to complete the square base.



7. Have someone from each group hold things in place as they get ready to erect their tent! Take the bottom layer of five triangles and form them into the shape of a pentagram and staple the last two bottom corners together. The triangle points should stand upward somewhat but will tend to fall over, and that's OK.
8. They will then take the middle layer of four triangles and position them on top of the bottom layer so that the bottom corners touch the pointed tops of the layer below. Twist pipe cleaners around each spot where the two layers join. As they work your way around, the tent should be more upright.
9. Have them place their pyramid on top and attach at the corners with pipe cleaners. Use tape to secure the last two newspaper roll braces diagonally from the top layer, forming a diamond-shaped door. The tent should be sturdy, but feel free to add tape or even craft sticks to reinforce any wobbly corners.





### CHECK FOR UNDERSTANDING

Have students answer the following questions in their teams or as a whole group discussion.

- What is the strongest shape? Why?
- How did they make their newspaper tent strong?
- How could they make it even stronger?



### WHAT'S HAPPENING

Triangles are considered the strongest shape because they can handle heavy loads without collapsing. This is exactly why engineers use them in structures. Many bridges, for example, are made up of trusses, which is a series of triangles connected together. Look for triangles the next time you see a bridge or building under construction.

This tent is similar to a geodesic dome, which is a spherical or partially spherical structure formed from triangles. Geodesic domes can be found on playgrounds as climbing structures. Another example is the giant sphere at Epcot.



### DIFFERENTIATED INSTRUCTION

- Let students discover what the strongest shape is on their own. Before doing the Warm Up or the Activity, give each group a couple sheets of newspaper and some tape. Have them experiment with various shapes and thickness by folding, rolling and reinforcing their newspaper so it does not collapse as easily. When they are finished, give each group an opportunity to share their results. Facilitate a discussion about their shapes. Do the Warm Up demonstration and discuss why triangles are stronger.
- Assign each group member a specific job to facilitate teamwork. For example, one person can be in charge of the tape, and another person can be in charge of the stapler or pipe cleaners.



### EXTENSIONS

- Facilitate creativity by letting students cover their tents with sheets of newspaper, designing a flag for the top, etc.
- Have students brainstorm a way to test the strength of their tents.
- According to the Environmental Protection Agency, paper makes up nearly 30 percent of all waste in America each year. Recycling saves trees, energy, and money, and it reduces waste and reduces climate change. Facilitate a discussion about recycling, and ensure all newspapers get recycled.