




Tallest Paper Tower Challenge

Experimental Procedure

This project follows the  [Engineering Design Process](#). Confirm with your teacher if this is acceptable for your project, and review the steps before you begin.

The objective of the [2021 Engineering Challenge](#) is to build a paper tower that is as tall as possible and can support a can of food at the top. Figure 3 shows several examples. If you have not already done so, watch this video for an overview of the challenge before you proceed.

<https://www.youtube.com/watch?v=dJr2DJRky5c>

Rules

1. The tower can only be built from paper and tape. See the [materials list](#) for allowable types of paper and tape. Tools cannot be used as structural elements of the tower.
2. You cannot use more than 30 pieces of paper.
3. You cannot use more than one roll of tape.
4. The bottom of the tower can only be taped to the horizontal surface that it rests on (floor, table, etc.). It cannot be taped to anything else (like the vertical leg of a table or a wall) or supported by a person.
5. You are allowed to fold, bend, roll, cut, etc. the pieces of paper.
6. Material cost is not prorated. If you cut a sheet of paper in half and only use half the sheet, it still counts as a whole sheet.
7. For scoring purposes, 1 piece of paper is 1 sheet of paper.
8. The tower must support one can of food (14–16 oz or 400–500 g) for at least 1 minute without collapsing. You cannot touch, modify, or repair the tower during this minute.
9. The can must rest freely on the tower and be removable. It cannot be taped to the tower.



Image Credit: [Ben Finio, Science Buddies / Science Buddies](#)

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Figure 3. Three examples of paper towers that comply with the contest rules.

Design

Before you start building anything, it is a good idea to brainstorm some different designs. Try sketching your designs out on paper (paper used for sketching does not count toward the total used to build your tower). Remember that there is an inherent trade-off in your design. Your score depends on both the height of your tower *and* how much paper you use. So, it is possible for a shorter tower that uses less paper to beat a taller tower that uses more paper. However, a tower that uses less paper may be weaker and have a harder time supporting the weight of the can. Can you design a tower that is tall, lightweight, *and* sturdy?

Build

Once you have decided on a design, it is time to start building. You might want to practice building individual elements (for example, single beams, or connections between beams) of your tower before you try to build the entire thing. You also might want to test your tower as you build it—for example, by pressing on it gently to make sure it is sturdy enough—instead of waiting until the very end and then putting the can on top. Your design might not work as you had planned, and this is okay! Engineers do not always get things right on the first try. If your tower is not as sturdy as you thought, you can modify it (for example, by adding more tape or reinforcing beams) or go "back to the drawing board" and start over with a new design. Only paper used in your *final* design counts when calculating your score.

Test

When you have completed your tower, test it by gently placing the can on top. Keep your hands nearby and ready to catch the can in case it falls or the tower collapses. If your tower starts to buckle or sag and does not look like it will hold the can for an entire minute, you should reinforce it before you proceed to the official test. Make sure you keep track of the total number of pieces of paper used in your final design.

Official Test

For the official test:

1. Place the can on top of the tower and immediately start the stopwatch.
2. Wait for 1 minute to make sure the tower does not collapse. It is okay if the tower begins to sag or buckle, as long as the can does not touch the ground, but you cannot touch, repair, or modify the tower during this minute.
3. After 1 minute has elapsed, use a tape measure or meterstick to measure the distance (in centimeters) from the supporting surface (floor, tabletop, etc.) to the *bottom* of the can. If necessary, you *are* allowed to use your hands to stabilize the tower or the can when taking your measurement, but do not *lift* the can to a higher height (this helps ensure that you do not accidentally knock the can over with the tape measure or meterstick—that would be frustrating!).

Scoring

Calculate your score using this equation:

$$\text{Total Score} = (\text{Distance to the bottom of the can in centimeters}) - (2 \times \text{number of pieces of paper})$$

Remember that the number of pieces of paper is equal to the number used in your final design. Paper used in earlier prototypes or for sketches does not count.

Frequently Asked Questions (FAQ)

If you are having trouble with this project, please read the FAQ below. You may find the answer to your question.

See the following links for more details about the challenge:

- [2021 Engineering Challenge Summary](#)
- [Tallest Paper Tower Challenge Instructions for Students](#)
- [Elementary School Tallest Paper Tower Lesson Plan](#)
- [Middle School Tallest Paper Tower Lesson Plan](#)
- [High School Tallest Paper Tower Lesson Plan](#)

Q: Can I use materials not listed in the Materials section?

A: If you are doing this project for a science fair or just for fun, you can use whatever materials you want. If you want to enter the 2021 Engineering Challenge, you can only use the items listed in the Materials section.

Q: Can I use other tools?

A: To keep the competition fair, you can only use the tools listed in the Materials section.

Q: Am I allowed to cut the paper?

A: Yes, you are allowed to cut the paper. However, remember that the material costs are not prorated. If you cut a sheet of paper in half and only use half of it, you must still count the entire sheet of paper when calculating your score.

Q: I used and then discarded some paper while testing different designs. Does the discarded paper get subtracted from my final score?

A: No, only the paper that is used in your *final* design is included in your final score.

Q: Can I do multiple tries for the official test?

A: Yes. You can test your tower (and keep making it taller) as many times as you want, but you can only submit one score.

Q: My tower collapsed when I put the can on top. Can I fix it?

A: Yes, you can repair your tower and try again.

Q: My tower started to collapse or buckle when I put the can on top, but it did not collapse. Can I straighten it out before I measure the height of the can?

A: No, you must measure the final height to the bottom of the can. However, you can fix the tower and start over with a new 1-minute test.

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You can find this page online at: https://www.sciencebuddies.org/science-fair-projects/project-ideas/CE_p027/civil-engineering/tallest-paper-tower-challenge?mode=procedure

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