

Competition Criteria

Challenge Summary: Each student group constructs a tower using straws and tape. Rather than designing the towers for height, design them to bear the most weight.

Materials:

- disposable plastic drinking straws
- masking tape
- gram scale (or kitchen scale)
- a large stack of identical magazines

Building process: Student teams spend time building their towers over several class periods. After a set amount of time (or once all groups have final designs), the competition begins.

Competition start: Each team registers its entry with the judge, and records its tower weight using the gram scale.

Strength testing: One by one, each tower is subjected to testing. A student group adds standardized weight in the form of magazines, one at a time, to the top of the tower. Once the tower fails—falls over, breaks or is otherwise unable to support the magazines—the test is over. The number of magazines that the tower supported, immediately prior to tower failure, is the number recorded as the maximum magazines held.

Recording weight: Since all magazines used are identical, record the weight of one magazine, and multiply that by the number of magazines that the tower held prior to failing.

Selecting a winner: The competition winner is determined based on the strength-to-weight ratio of the tower. Light towers that hold a lot of magazines have higher strength-to-weight ratios.

Tie-breakers: In case of a tie, the lighter tower wins.

Judging Rubric

Criteria	Indicator	Outcome
C1. Only the supplied straws and tape are utilized in the construction of the tower.	yes or no	Yes: Move on to C2 No: <i>Tower is disqualified</i>
C2. The tower is free-standing, only touching the surface it is placed upon.	yes or no	Yes: Move on to C3 No: <i>Tower is disqualified</i>
C3. The tower is at least 60 cm tall.	yes or no	Yes: Move on to C4 No: <i>Tower is disqualified</i>
C4. Tape has <u>not</u> been used as a “rope” to reinforce straws outside of straw-straw joints.	yes or no	No tape ropes: Calculate the weight-to-strength ratio Has tape ropes: <i>Tower is disqualified</i>

Name: _____ Date: _____ Class: _____

Calculating the weight-to-strength ratio:

1. Using a gram scale, typically used in kitchens to measure flour, weigh the straw tower.

Straw tower weight = _____ grams

2. Begin adding magazines (that are all identical) to the top of the tower, one at a time, until the tower fails. Keep count of the number of magazines added.

Number of magazines added = _____ magazines

3. Weigh one of the magazines using a gram scale, and record its weight.

Individual magazine weight = _____ grams

4. Calculate the strength-to-weight ratio using the following equation:

$$\text{ratio} = [\text{magazine weight}] \times [\text{number of magazines}] \div [\text{tower weight}]$$

Magazine weight was recorded in 3, the number of magazines was recorded in 2, and the straw tower weight was recorded in 1.

Our initial tower's strength-to-weight ratio = _____

Our final tower's strength-to-weight ratio = _____

The tower with the highest strength-to-weight ratio wins!