Pasta Tower

1. **DESCRIPTION**: The objective of this event is to design and build the lightest tower, constructed only of pasta and glue, with the greatest structural efficiency, capable of supporting a load of up to 10 kg.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 10 min.

5. **TEAMS**: Teams must bring tower and safety glasses.

6. **EVENT LEADERS**: Will provide all equipment, except for eye protection, needed for testing and scoring. The equipment needed is as follows:
   a. A flat surface testing platform with a 10.0 cm x 10.0 cm square opening in its center.
   b. A square loading block, 5.0 cm long x 5.0 cm wide x 2.0 cm tall (+/- 1 mm) with a hole drilled in the center of the square face. Connected through this hole will be a ¼" eyebolt (with wing nut and washer) connected to a chain. The loading block and chain assembly is placed on the tower by the team during testing and used to suspend the bucket and sand beneath the tower.
   c. An electronic balance or scale that can mass up to 12 kg (the "sand scale") and one that can mass a tower up to 400 g to the nearest .1 g (the "tower scale"). Towers exceeding the capacity of the tower scale will be massed on the sand scale instead.
   d. A plastic tarp to protect floor from sand, if needed.

Loading Block & Chain

7. **SAFETY REQUIREMENTS**: Teams must wear Z87+ safety glasses throughout event.

8. **IMPOUND:** None.

9. **CONSTRUCTION:**
   a. Prior to the tournament, participants will construct a pasta tower that is a single structure at least **30.0 cm** tall, constructed of only pasta and either hot glue and/or white school glue. No other materials may be used. There is no maximum height. Homemade pasta is allowed, but additional ingredients, such as metal fibers, cannot be added to the dough.
   b. The pasta tower must be built so that a 5.0 cm long x 5.0 cm wide x 2.0 cm (+/- 0.1 cm) thick square loading block may be placed on top of it. All parts of the loading block must be a minimum of 30.0 cm above the testing platform before the load is applied. The loading block must be supported so that a chain, suspended from its center, can be threaded through the middle of the tower so that it is within 2.5 cm of the center of the opening in the testing platform. Towers should be constructed to ensure the chain does not contact the tower at any point.
   c. Towers must be able to span the 10.0 cm x 10.0 cm opening on the testing platform.
   d. No portion of the tower may extend below the top surface of the testing platform.

10. **THE COMPETITION**:
    a. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials, or communication until they are finished competing. Only contestants and judges will be allowed in the event area while teams are competing. Teams violating this rule will be disqualified.
    b. All towers must be measured and weighed prior to testing.
    c. Teams must strive to handle the tower themselves throughout the process of measuring and loading. Event leaders should only handle towers as a last resort.
    d. Teams must place the tower on the testing platform themselves so that the corners of the tower rest on the top surfaces of the testing platform.
    e. Teams will place the loading block on the tower at the top center, so the chain hangs freely without touching the testing platform and connect a 5-gallon bucket to the chain below the testing platform.
    f. The team will be given **3 minutes** to load sand into the bucket once the loading block and tower are positioned.
    g. Loading must stop when failure of the tower occurs, when the maximum load of 10 kg is supported, or when the time expires, whichever occurs first. Failure is defined as the inability of the tower to support additional load, or something other than the tower is supporting the load (i.e., the tower leans and chain touches edge of platform, or sags enough that the bucket touches ground, or part of the tower sags below the top of the testing platform).
    h. Event leaders will remove sand added after failure occurs. Event leaders will also remove any pasta bits that fall into the sand. The Load Supported at that time will be used to calculate the Structural Efficiency.
    i. The mass of the loading block assembly, bucket, and sand are included in the Load Supported.

11. **SCORING**:
    a. The best structural efficiency (highest number) wins, determined by the following equation:
    Structural Efficiency = Load Supported (grams) ÷ Mass of Tower (grams)
    b. Towers that hold more than 10 kg will be scored using 10 kg (10,000 g) as the maximum Load Supported.
    c. Towers will be scored in 2 tiers:
    Tier 1: Towers with no violations
    Tier 2: Towers with construction violations
    Towers that cannot be tested for any reason (e.g. cannot accommodate the loading block or team does not have proper eye protection) will be given participation points only.
    d. Ties will be broken in favor of the team with the lighter tower.

12. **RESOURCES**:
    See the Event Resources tab on our website at www.sciencenc.com for instructions, videos and more.