

Bottle Rockets (NC Only 2023)

1. **DESCRIPTION:** Prior to the tournament, teams will construct up to two rockets designed to stay aloft for the greatest amount of time.

A TEAM OF UP TO: 2

IMPOUND: No

MAXIMUM TIME: 10 min.

2. **EVENT PARAMETERS:**

- a. Teams must design, build, and bring up to 2 rockets.
- b. Teams will make up to two launches. Teams may use the same rocket on both launches or use two different rockets.
- c. Teams may bring funnels, measuring cups, and/or other tools to help prepare their rockets. These will not be provided by the Event Leader.
- d. Event Leaders will provide the launcher, water, score sheets, and timers.

3. **SAFETY REQUIREMENTS:**

- a. Teams must wear safety glasses rated Z87+ during the loading and launching of their rockets.
- b. Teams must never be near a rocket after it is pressurized under any circumstances.
- c. Teams must use only *unaltered carbonated* beverage bottles as pressure vessels.
- d. Metal of any type is prohibited anywhere on the rocket.
- e. Rockets must not have a sharp or leading edge.
- f. Explosives, gases other than air, chemical reactions, pyrotechnics, electric or electronic devices, elastic powered flight assists, throwing devices, remote controls and tethers are prohibited at any time.

4. **CONSTRUCTION PARAMETERS:**

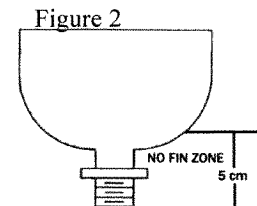
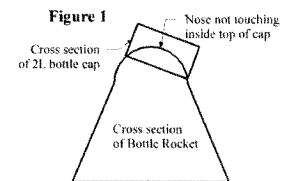
- a. **PRESSURE VESSEL:** The rocket pressure vessel is the part of the rocket that attaches to the launcher and is filled with water and air. The **PRESSURE VESSEL:**
 - i. Must be made from a single **1-liter** plastic carbonated beverage bottle
 - ii. Must have a neck/nozzle opening internal diameter of approximately 2.2 cm. Not all bottles are made the same, and there is no one specific brand that is guaranteed to work. Some bottles will not fit on the launcher. The easiest way to test this is by sliding a piece of 1/2 inch PVC into the bottle. If it fits loosely, the bottle will go on the launcher. If the PVC sticks and you must apply any force to slide the PVC in, the bottle will not go on the launcher.
 - iii. Labels may be removed but must be presented at the safety inspection to prove that the pressure vessel is carbonated. *Pressure Vessels without labels will not be launched.*
 - iv. Must not be altered in any way to compromise its structural integrity This includes, but is not limited to physical, thermal, or chemical damage (e.g., cutting, sanding, using any glues). Event leaders must assess the structural integrity by looking through the nozzle and sides of the pressure vessel for discoloration, bubbles, thinning or cuts in the walls or glue of any kind. *Rockets violating this rule will not be launched.*

- b. **MATERIALS:**

- i. Metal of any type (including tape with metal fibers) is prohibited everywhere on the rocket. *Rockets violating this rule will not be launched.*
- ii. Toy or professional rockets or parts of rockets are not allowed.

- c. **NOSE CONE:** Rockets must use a blunt or round nose. The nose must be designed such that when a standard bottle cap is placed on top of the nose, no portion of the nose touches the inside top of the bottle cap (see Figure 1). Teams must not use a nose that is sharp, pointed, or consisting of a rigid spike regardless of the material used. *Rockets violating this rule must not be launched; this is a safety issue.*

- d. **FINS and OTHER PARTS:** Fins and other parts added to the pressure vessel must be 5 cm or higher above the level of the bottle's opening to ensure the rocket fits on the launcher (see Figure 2). Allow teams to fix if possible, to allow for launch.



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- e. **ENERGY SOURCE:** Explosives, gases other than air, chemical reactions, pyrotechnics, electric or electronic devices, elastic powered flight assists, throwing devices, remote controls and tethers are prohibited at any time. All energy imparted to the rocket at launch must originate from the water/air pressure combination. *Rockets violating this rule must not be launched, as this is a safety issue.*
- f. **RECOVERY SYSTEM:** Any free-fall recovery system is allowed, but not required, if it does not violate any other rule; however, the recovery system must be judged as safe.

5. **THE COMPETITION:**

- a. Teams must arrive at the competition site ready to launch with proper eye protection on. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows, otherwise they will not be allowed to compete and receive participation points only.
- b. Following the safety inspection of the rockets, teams may add any amount of water to the inspected rocket(s).
- c. All rockets will be launched at **60 psi**. Once the rocket is pressurized, no team member may touch or approach the rocket.
- d. Time aloft is recorded in hundredths of a second. Timing begins when the rocket separates from the launcher and stops when any part of the rocket touches the ground, goes out of sight, or is noticeably slowed by an obstruction (e.g., a tree or building).
- a. Event leaders are strongly encouraged to use three independent timers on all launches. The middle value of the three timers must be the officially recorded time.

6. **SCORING:**

- a. Rockets that violate a safety-related rule will not be launched and will receive participation points only.
- b. Ranking within each tier is determined by the greatest time aloft for **one rocket** flight.
 - i. Tier 1: Rockets launched without any violations
 - ii. Tier 2: Any launch with competition violations, or a non-safety construction violation.
- c. Ties in tiers 1 and 2 are broken by the better score of each tied team's other rocket.

7. **EVENT RESOURCES:**

See the Event Resources tab on our website (ncscienceolympiad.ncsu.edu) for instructions, videos and more.