

BOTTLE ROCKETS

DESCRIPTION: Teams will design, construct, and launch rockets to stay aloft the greatest amount of time. Contestants that do not bring and wear approved Chemical/Splash Protection Goggles will not be allowed to launch their rocket(s). See: <http://www.soinc.org/general/protection/>

A TEAM OF UP TO: 2

APPROXIMATE TIME: 30 min./6 min. for prep and launch

IMPOUND: Yes

1. CONSTRUCTION:

- a. Students will bring one or two rockets to the tournament that use a two-liter plastic carbonated beverage bottle with approximately 2.2 cm internal diameter neck (1/2 inch Schedule 40 PVC pipe should just fit inside the neck opening). Contestants should keep and bring a journal recording all phases of their rocket development. The journal will be used for breaking ties.
- b. The structural integrity of the pressure vessel (2-liter bottle) may not be altered. Examples of altering structural integrity include but are not limited to physical, thermal or chemical damage (e.g., cutting, sanding, using hot glues, or super glues). Adhesive may be used to attach fins and other components but must be limited to glue such as silicone adhesive, polyurethane based adhesives and others that do not damage the structural integrity of the pressure vessel.
- c. Teams must verify the bottle used for the rocket's pressure chamber is a carbonated beverage bottle by impounding with each rocket another bottle of the same type with its label intact.
- d. Rockets may not use extenders that increase the 2L volume. Commercial model rockets or model rocket parts may not be used. The rocket(s) must be marked so that the judges can identify to which team they belong.
- e. Metal may be used, but may not be attached to or have direct contact with the pressure vessel at any time. For safety, rockets may not use sharp or pointed metal components or a leading surface consisting of a rigid spike. The total mass of the rocket and recovery device must be a minimum of 150 grams for regional, 175 grams for state and 200 grams for national tournaments. A balloon filled with dry sand is suggested if ballast is needed. The total mass of the empty rocket and recovery device cannot exceed 400 grams.
- f. Rocket components may separate in flight, but must remain linked together. The maximum extended length of the rocket and its components shall not exceed 3 meters.
- g. All propulsive energy imparted to the rocket must originate from the water/air pressure combination provided by the judges. Other forms of potential or kinetic energy may be used for deployment of rocket recovery devices and other components, but may not be used to slow the rockets descent. Remote controls, pyrotechnics or pressurized gases (except for the original air pressure) may not be used.
- h. Rockets may use any type of recovery device (including parachutes) that is safe and doesn't violate the rules.
- i. All rockets will be launched using the launcher provided by the supervisor. Contestants are responsible for ensuring their rocket is capable of launching from the launcher provided. To insure rockets will fit on the launcher, fins and other parts added to the bottle may not extend below the flange on the bottle's neck. The portions of the parts and fins within the bottles radius may not extend closer than 2 cm above the level of the flange on the bottle's neck.

2. THE COMPETITION:

- a. All rockets must be impounded before the start of the competition and will be released after the last team has finished competing. Once impounded, no physical alterations may be made to the rocket. Appeals by teams will not be processed after they remove their device from impound unless it has been released by the appeals committee.
- b. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials or communication until they have finished competing. Only contestants and judges will be allowed in the event area while teams are competing. Teams violating this rule will be disqualified.
- c. When it's their turn, contestants will pick up their rockets and proceed to the designated staging area to prepare their recovery system. After a safety inspection, the contestants will be allowed six minutes to prepare and launch their rocket(s). The six-minute time will include adjustments to the rockets, adding water, launch of both rockets and timing of the first flight. Contestants will not be allowed to add water and launch their rockets without approved eye protection.
- d. Teams may not shield their rocket from the wind while on the launcher.
- e. All rockets will be launched at a pressure requested by the competitors, not to exceed 60 pounds per square inch. Once the rocket is pressurized, contestant may not touch or approach the rocket.
- f. Timing of the rocket stops when the first part of the rocket hits a stationary object (ground, building, tree, etc.) or when the rocket disappears from the judge's sight. All rocket launch times will be recorded to the nearest hundredth of a second. Preferably three timers should be used and the middle time should be recorded.
- g. Only one launch is allowed per rocket. Any rocket launched before the time expires will be scored.
- h. Each team will be asked to explain an entry in their journal randomly chosen by the judges.

3. SCORING:

- a. All rocket launch times will be recorded to the nearest hundredth of a second. A team's score will be the flight time of the rocket that gives them the higher rank. The greater flight time wins.
- b. Rockets whose parts do not remain linked while aloft will be ranked by their flight time in a second tier after those that remain linked.
- c. Rockets that violate any rule that doesn't have a specific penalty will be ranked in a third tier by their flight time.
- d. Teams that attempt to participate but are unable to launch at least one rocket for any reason will receive participation point(s) only (e.g., participants did not have eye protection, rockets failed safety inspection or rocket would not fit on launcher).
- e. When teams that launched two rockets each are tied, the winner will be the team with the longer time aloft of the shorter flight. Teams that launched two rockets will win ties over teams that launched only one rocket. Remaining ties will be broken using the team's journal and their explanation of the entry chosen by the judges.

See: <http://www.soinc.org/events/botrockets/>
THIS EVENT IS SPONSORED BY PITSCO CO.

POLYMER DETECTIVES (DIVISION B) DRAFT

DESCRIPTION: The purpose of this event is to develop an awareness of polymers and plastics and how they affect daily living in a modern society. Students will be expected to demonstrate knowledge of common plastics, i.e., properties and uses, key terms, chemical formulas and structure, and scientists known for their work on these materials. No notes of any kind will be allowed. Students must bring and use OSHA approved splash goggles with indirect vents and chemical aprons. Open toed shoes are not allowed.

A TEAM OF UP TO: Team of up to 2

APPROXIMATE TIME: 50 minutes

THE COMPETITION: This event will consist of three parts:

Part I: Students may be given up to 3 unknown samples of fibers including cotton, wool, and no more than one synthetic fiber. Students will be expected to identify these by the reaction of these fibers with burn tests, and/or by examination with a microscope. Burn tests should be done with a match, lighter or candle.

Part II: Students will be expected to characterize samples of the following polymers. The characteristics they will be expected to determine by testing or by observation are density and information about the burn results. If the actual burn tests are done, they **MUST** be done as a demonstration under a hood or in an approved ventilation system by the event supervisor. The student may be provided written information about the burn test results for the polymers. Emphasis in scoring this part of the event is placed on careful and organized observation and identifying the polymers.

<u>Types of Plastic</u>	<u>Industry abbreviations</u>	<u>Resin code</u>	<u>Typical packing uses</u>
Polyethylene Terephthalate	PETE	1	Soda, peanut butter & vegetable bottles
High Density Polyethylene	HDPE	2	Milk, juice & detergent bottles, grocery bags
Polyvinyl Chloride (or vinyl)	PVC	3	Shampoo, salad dressing and water bottles
Low-Density Polyethylene	LDPE	4	Trash bags, food & bread wrap, squeeze bottles
Polypropylene	PP	5	Dairy prod. containers, bottle lids, drinking straws
Polystyrene	PS	6	Foam & clear contains for take out food, meat trays, egg cartons, plates, cups and cutlery

Sample Questions: (1) What is the density of this sample of the polymer? (2) Based on the information provided about the burn test, which type of polymer could this be?

Part III The other part of the competition will consist of a written test. Students will be expected to be able to do the following for the polymers in the list of part II:

- State common uses of polymers
- Provided with resin code, tell what the material is.
- Know information about recycling and disposing the polymer.
- Know basic information about how the polymers are made.

SCORING: Part I: 15 points Part II: 40 points and Part III 45 points. Ties are broken by using highest score from Part II first, then Part I and if needed Part III last. **TIME IS NOT A TIEBREAKER!**

FREE RESOURCE: American Plastics Council 1300 Wilson Blvd. Suite 800, Arlington VA 22209. 1-800-2-HELP-90. Website: www.HandsOnPlastics.com.