

**Problem Statement:**

Design and construct a water propelled rocket to be launched at any angle less than 75 degrees measured from horizontal. Maximum time of flight will be the winning criteria. A launcher also needs to be constructed which should be able to launch the rocket safely.

**General Rules:**

1. Students currently enrolled for up to an undergraduate/postgraduate program at their institute are eligible for the competition.
2. Number of members per team should not exceed three.
3. Every team has to register online at our website for the competition. A registration number will be allocated to the team on registration which shall be used for future reference.
4. There will be an elimination round for the competition during Techfest before the final round.
5. Three trials will be given to each entry and the best time of the three will be considered for judging for both the elimination as well as the final round.
6. Participants are allowed to use different rockets for these three trials.
7. Participants if qualify for finals, are permitted to use a different rocket from the one using which they cleared the elimination round.
8. Participants selected for the finals will have to give an introduction before the judges about the design of the rocket, launcher and the scientific principles used in construction of the rocket. The introduction has to be very brief.
9. If the rocket fails to satisfy the safety norms in any of the trials, it will be counted as a missed trial.
10. The launching mechanism should be such that the participant remains at a safe distance of at least 2 meters while launching.
11. Participants can use various mechanisms like parachutes etc. to increase the time of flight.
12. Participants are allowed to bring their own pumps. A standard pump along with the pressure gauge shall be made available details of which will be put up here soon.
13. All methods of compressing air are to be manual i.e. with a foot or bicycle pump.
14. Judges decision shall be treated as final and binding on all.

**Other Constraints:**

1. Only water should be used as the propellant. No other gas than air is allowed to be pressurized and provide thrust to the rocket.
2. There is no restriction to the size of the bottle/container to be used for the rocket but only one bottle should be used or in other words only single stage rockets are allowed for the competition.
3. Maximum launching pressure allowed is 5 Bars.
4. No ready made products like nose-cones, fin etc. should be used for the rocket. The rocket body has to be completely self-made.
5. Ready made parts like washers, clips, ties etc. are allowed to be used for the launcher, but the assembly has to be self made.
6. External metal parts are allowed on the launch mechanism but not on the rocket.
7. All energy imparted to the rocket must originate from the water/air pressure combination. No other potential, kinetic or any other source of energy will be permitted.
8. The launcher must remain stationary on ground while and after the launching of the rocket.
9. Rocket components may separate during the flight but are not allowed to detach completely from the rocket. For example, if a nose cone is used, it can separate, but should remain attached to the rocket body.
10. Each rocket will be fired from the edge of the landing zone towards the center. The dimensions of the landing zone will soon be available.
11. Timing of the rocket stops as soon as any part of the rocket touches the ground, or when the rocket disappears from the judge's sight, or when the rocket gets entangled with an object (e.g. the rocket collides with a tree).
12. Bottle chosen to construct the rocket should withstand the high launching pressure. Aerated cold drink bottles are suggested for the rocket. It is to be noted that standard cold drink bottles (Pepsi, Coke etc) can withstand a maximum of 8 bars of pressure.

**Hints & Tips:**

1. To keep rocket more aerodynamically stable there is a rule of thumb that states that the Centre of Drag (CoD) should be between 1-2 times the distance equal to the rocket diameter, behind the Centre of Gravity (CoG) .Where CoD can be found by making a cardboard cut-out of the sideways view of the rocket and finding its centre of gravity.

2. To lower CoD you can use wings or to rise CoG try using weights at Nose of Rocket.
3. Try using different kinds of nozzle, as nozzle size determines heights and speed achieved. (water hoses, bottle caps with modification, even open bottles themselves can be used as nozzles)
4. Use mathematical models to calculate correct water amounts to be used for specific bottle size and pressure used to get maximum heights or initial acceleration.
5. Try to design some good mechanism of filling water in the bottle to decrease loss of water during mounting rocket bottle on launcher (water need not to be filled before mounting but can be one possibility), this will also give u good approximation of flight beforehand.
6. To increase the time you can use parachutes or try reducing the nozzle size to decrease the velocity of rockets.
7. For launching the rocket, you can use cable ties to hold bottle in vertical direction (But many more methods too are available, try search on [www.google.com](http://www.google.com).)
8. Cable ties can also play major role in launching rocket from safe distance (Even some holding ring mechanisms are also available).
9. Try using smaller diameter pipes than major body for making variable height of tubes.

**Some Useful Links:**

- <http://ourworld.compuserve.com/homepages/pagrosse/h2oRocketIndex.htm>
- <http://www.h2orocket.com>
- <http://bradcalv.customer.netSPACE.net.au/wrbook.htm#safety>
- <http://homes.managesoft.com.au/~cjh/rockets/links.html>
- <http://www.lunar.org/docs/handbook/parachutes.shtml> (for parachutes)