



Water rocket as a tool to engage students in “principle of physics ” course



Sampart Cheedket
Division of Physics, School of Science, Walailak University, Thailand

Overview

The motion of water rocket can be explained by principle of physics in several topics: 1. projectile motion, 2. Newton’s law of motion, 3. fluid mechanics, and 4. thermodynamics.

Water rocket made of cola plastic bottle. Add head part and fins to transform a bottle to be a rocket. Fill some water into rocket. Install the rocket on the launcher. Fill the rest volume of rocket with compressed air (with pressure range: 3 – 6 bars or 40 – 90 psi). Release the rocket from launcher by maximizing the horizontal distance.

To maximize the rocket horizontal distance, several variables need to be optimized. For example, 1. lift angle, 2. water volume, 3. bottle volume, 4. air pressure, 5. fluid density (if replace water by other dense fluids).

Aim and objective

students should apply principle of physics knowledge, they have learned to optimize all rocket variables to maximize their rocket horizontal distance.

Activity

Five groups of students to do experiment finding the optimized given variable with maximize horizontal distance. each group report the experimental result of given variable. Each group optimize their own rocket variables for the final competition.

Outcome

- Optimized variables from 5 experiments
- Lift angle (30 – 75 degree) : 45 degree.
- Air pressure (3 - 6 bars): 6 bars
- Water volume (0 -700 ml, 1.25L) : 400 ml (32 % of bottle volume
- Bottle volume (1.25 -2.9 L): 1.5 L
- Dense fluid (water, palm oil, flour) : flour

Impact

In competition, 22 students are divided into 11 groups. Every group pass the required distance. Instead of water most of them change to use flour as the dense fluid of rocket (8 of 11). Flour rocket carry longest distance by 174 meters, while water rocket carry longest distance by 120 meters.

All students are engaged to experiment and competition. My overall satisfied score which was evaluated by students after course has significant improved from 4.13 of 5 last year, to 4.51 of 5 this year.

Future development

I will repeat this project again next principle of physics course.

References

- Hugh. D. Young, Roger A. Freedman, “University Physics, 13th edition ”, Addison-Wesley, 2012.

