

Water Rocket

PROJECT OVERVIEW ▶

NEWTON'S LAW REVIEW ▶

DESIGN/CONSTRUCT/TEST ▶

Project Rules

EXPERIMENTAL STRATEGY ▶

NASA Simulator

Strategy of Experimentation

TECHNICAL PRINCIPLES ▶

Forces/Design for Flight
Simulator Equations

PHYSICS OF WATER ROCKET ▶

FINAL DESIGN/TRIAL ▶

ROCKET RUBRIC ▶

Overview

The unit opens with a worksheet to review basic Newton's Laws which had been covered in 9th Grade Physics. Each student is required to make a concept map, which is later shared and compared with the other members of the project group.

The rules are very straightforward. A water rocket is to be constructed from a 2 L soda bottle. It will be propelled by pressurized water. The students use a NASA simulator specifically for 2L bottles in order to optimize the design variables.

The simulator has 12 inputs. However each student is required to obtain the optimal results in 10 simulations. This restriction forces them out of the one variable at a time thinking and requires them to learn about strategies of experimentation and devise their own. This restriction requires a grouping of most important variables and a well-designed spreadsheet. Individual spreadsheets after the individual trials are compared with their group. Students see a different way to approach experimentation and the spreadsheets become more organized.

Each student take his best result forward to the group. From this starting point, the group has 10 additional simulations to determine their final design.

The technical principles and the physics are covered during the class time.

The group then constructs their rocket according to the design. Compromises invariably must be made; these must be justified and reported. The quality of construction can vary significantly from group to group. For example, flimsy fins will create additional drag, heavy nose cones reduce drag, but contribute to the weight. Before testing, the completed rocket is presented to the class for review and comments.

They are then tested in the schoolyard. The flight height is determined using measurements from 2 altimeters. There is invariably informal and spirited competition. The report covers all aspects and includes a comparison and critique of the performance against the design.

The equipment for launch and the procedures as well as excerpts from student reports will be covered in a section to be available soon.