

Last updated on April 27, 2008

Newton's Laws and Water Rockets

Day 2

Lesson Objectives:

1. Test water rockets
2. Be able to identify what worked well in rocket design and what didn't

Materials:

To finish building rockets:

- Rocket from last week
- Scissors, construction paper, cardboard
- Duct tape

To launch:

- Water rocket launch pad
- Bicycle pump

Finish Building Rockets (10 minutes)

Have students get into their groups from last week, and remind them that they have 10 minutes to finish building. (**NOTE: Do not let the building process last more than 10 minutes, because the launching section cannot be cut short.**)

Brief Review of Physics (5 minutes)

Remind students about Newton's three laws of motion, but focus on the 2nd and 3rd laws ($F = m \cdot a$, every action has an equal but reaction). Talk again about how they apply to the rocket flight, as it will help the students decide how much water to put in their bottles. (Too little water won't provide a large enough reactive force on the bottle, but too much water will make the rocket too massive and it won't fly very high either.)

Last updated on April 27, 2008

Launching (30 minutes)

Have the students form a line to **fill up their water rockets** with the amount of water they choose. (For the tutors: a good amount of water is anywhere from $\sim 1/6$ to $1/3$ of the bottle).

IMPORTANT: Safety is critical here. Make sure that students stand more than 15 feet away, and only tutors can use the pump. Also, do not push the stopper too hard into the bottle as it may lead to dangerously high pressures before the bottle pops off.

Operating the launcher:

Push the stopper attached to the bike pump into the end of the bottle (firmly, but not very hard). Place the bottle upside down on the launcher with the bike pump head in the groove in the wood. Make sure that the bottle is tilted slightly away from the person operating the pump, and begin to pump air into the rocket. **IMPORTANT: if the bottle does not pop off immediately, do NOT go up to it. Keep pumping, and it will eventually pop off of the stopper.**

Discussion of Tests (15 minutes)

Talk to the students about what worked well and what didn't. How high did the rockets go? Was there an optimal amount of water? Try to tie this into the scientific method. Each group varied the amount of water they used, and we kept the pressure (almost) constant. Have them draw some conclusions. If there is time, talk about other things we could study about the water rockets. Suggestions include varying the pressure or the size of the bottle (using a 12 oz soda bottle instead, for example). Ask the students what they think will happen if we vary the parameters they suggest.