chillistick

The Rocket

(A Statutory Forces Experiment)

Time

Allow 15 minutes as this must be done outside.

After that each launch takes 2-3 mins

WHAT YOU'LL NEED

(Provided in Primary Science Pack)

- Plastic Water Bottle Rocket
- Bottle Plug
- Jug Launcher
- Black Funnel Loader
- Dry Ice

Always replace lid on dry ice box immediately after

You will also need:

- Water
- Safety Glasses
- Deserted Playground/field
- Long Tape Measure (optional)
- Paper Towels or similar

This experiment can be used as part of the statutory requirement to teach Forces. It covers both air resistance and the force of gravity.

BACKGROUND

We said the fruit ice cream was the best demo. Well it's not, this is. The rocket is an empty drinks container which will travel 10 metres vertically and so this experiment **must be** done outside.

What To Do

1. Optional: several days prior to the demonstration ask the class to decorate a number of empty 1 – 2 litre capacity plastic drinks bottles. Perhaps this can be done in teams so that you have say 4-5 launches in total. Explain that the plan is to see which rocket will travel the furthest.
2. Ensure that you have a playing field or similar to yourselves. Ask the children to line up 3 – 4 metres behind you. On a flat surface fill the bottle with xx ml of cold water (about 1/5th full).
3. Wearing safety glasses and using the funnel put 5 good pieces of dry ice in the top of the bottle. You will see some fog starting to form.
4. Place the plastic bottle plug so that it rests on the top of the bottle and then place the jug over the bottle. As you push down on the jug you will push the plug into the bottle. Do this as firmly as you can.
5. Grasping the neck of the bottle turn the jug and bottle over whilst holding the jug by the handle. Do this so that the rocket is never pointing at anyone.
6. Holding the launcher jug by the handle aim the rocket at an angle of about 45 degrees into the field (and away from the children).
7. The rocket will fly off after about 20 - 60 seconds. The plug will be trapped in the launcher jug and can be re-used. Most of the water will be caught by the jug even though it is quite possible that the demonstrator may get a bit wet.
8. Measure how far the rocket went to determine who wins.
9. Consider experiments to investigate air resistance, e.g. would a nose cone make the rocket go further? Perhaps taping the red lid supplied in the Primary Science Kit.

chillistick

The Rocket

(A Statutory Forces Experiment)

Time

Allow 15 minutes as this must be done outside.

After that each launch takes 2-3 mins

What's Happening?

The water is heating up the dry ice and in so doing causes the formation of carbon dioxide gas which needs much more room than the solid form. This causes the pressure in the bottle to rise until the plastic bung is pushed out. The pressure of the carbon dioxide gas also expels all the water and any residual dry ice pellets. This gives the plastic bottle thrust and this is why it flies off, just like a real rocket. (Except in our case we don't have an pesky electronics or astronauts on board.)

Make this an experiment

To turn this demonstration into a true experiment ask the junior scientists to answer these questions:

- **How to make the rocket go further—would a bigger bottle help?** Try it out
- **Would the shape of the rocket make any difference? -** A nose cone would reduce air resistance, perhaps get one made out of cardboard and see what happens.
- **What about changing the angle the launcher is held?** - Definitely!

  What would happen if warm water was used (rather than cold) The rocket will go off more quickly, so best avoided! **Please stick to cold water.**

- **More dry ice?** You need the minimum ice necessary to generate enough pressure to push the bung. Any dry ice that is pushed out will help the rocket go further. However after that any ice that remains stuck in the rocket will just weigh it down in flight. Extra payload as we rocket scientists call it!
- **More water?** (see comments for extra dry ice). We suggest 300ml but try different amounts. Perhaps ask students to plot water amounts versus rocket distance.

Class discussion—principles of the rocket demonstration (the experiment must be outside!)

Picture courtesy of The Greyhouse School, Hartley Witney

TEACHER'S NOTES

Using the equipment supplied and following these instructions means that the demonstration is very safe – as always please read the safety Information on dry ice provided with these downloads and available from www.chillistick.com

Our suggestion is to optimise the distance travelled (our record is 30 metres!). Tell us how you get on