Building and Launching a Model Rocket
Activity Part 1

Directions

1. Have the children gather all the items needed to construct their model rockets.

Children will need oak-tag poster board with the rocket cut-out pattern, 35-mm film canister, scissors, tape, and rocket-decorating supplies.

Fuji Film© canisters are recommended because their caps attach into the inside of the canister, which enables them to pop off cleanly once sufficient pressure builds up inside the canister to blow the lid off. Film canisters with lids that grip the outside of the canister do not pop off in a consistent manner.

Use a copy machine to copy the rocket cut-out pattern onto poster boards in preparation for this activity.

2. Explain that they will need to cut out the rocket parts from the cut out pattern on the oak-tag poster board as these parts are scaled to fit onto the 35 mm film canister.

Show the children a sample model rocket that you have constructed.

Have them decorate the parts of their rocket before assembly.

3. Wrap the rocket body section around the film canister so that the lid of the canister can be snapped on and off without interference. Important — be sure to securely tape the rocket body to the film canister before wrapping the body into a cylinder. Tape the outside seam of body cylinder closed. Refer to the illustrated instructions (From *Rockets: A Teacher's Guide with Activities in Science, Mathematics, and Technology*, 1996).
4. Tape the fins onto the rocket, making sure that they are evenly spaced around the base of the rocket body.

5. Roll the nose cone section into a cone shape that is the same diameter as the rocket body. Tape along the seam to hold the nose cone together. Next tape the nose cone to the top of the rocket body.

Launching a Model Rocket

6. Choose a launch platform that is outside or in an uncarpeted room with a high ceiling at least 20 feet tall. All children other than the child launching his/her rocket should stand at least 10 feet back from the launch area. Make sure that the child launching his/her rocket is wearing eye protection.

7. Turn the rocket upside down, take off the film canister lid, and place 1 teaspoon of vinegar into the film canister.

8. Measure 1/2 teaspoon of baking soda.

9. Pour the baking soda into the film canister. Quickly snap on the film canister lid and quickly place the rocket rightside up onto the launch platform. Step back from the launch platform.

These steps need to be completed very quickly as it only takes 3–5 seconds for sufficient gas pressure to develop to blow the lid off the film canister.

Note: *Alka-Seltzer and water can be substituted for the baking soda and vinegar in this experiment. Place 1/2 of an Alka-Seltzer tablet into the canister, then fill the container 1/2 to 3/4 full of water. Snap the lid closed and follow the activity procedure.*

To add a sense of realism, have the children count down backward from 10.

Have the children judge the relative height of each launch by referencing the maximum height to a specific point on a background object.

10. After each child has launched his/her rocket, help the children think about this activity by discussing the following questions.

- Why did some rockets fly higher than others?
- How is your rocket similar to, and different from, a real rocket?
- What caused the rockets to move?
- What could be changed to make the rockets fly higher?
- What would happen to the rocket's flight if you removed the nose cone and/or the fins?
- What would happen if two similar rocket engines, facing directly opposite each other, were ignited at exactly the same time?

Challenges of Launching Heavy Rockets
Activity Part 2

Directions

11. Give each child a piece of modeling clay about an inch square. Have them make smaller pieces of the clay into flat disks the same size and thickness as a quarter.

This should yield 5 or 6 quarter-sized pieces of clay. Emphasize that they should make each piece as equal in mass as possible.

12. Carefully take off the nose cone. Place a quarter-shaped piece of clay inside the rocket body, on top of the film canister. Tape the nose cone back onto the rocket.

Ask the children to predict how the weight of the clay will affect the flight of their rocket.

13. Follow the same procedure for loading the baking soda and vinegar into the film canister as previously described in steps 7–9 (see Activity Part 1).

Have the children judge the relative height of each launch. Have them write down the height reference point for this launch with this amount of clay.

14. Repeat steps 12 and 13 above, each time adding one more piece of clay to the rocket.

Emphasize that they should try to use the same amounts of vinegar and baking soda each time.

15. Ask the children to summarize their experimental results.

Although their observations are qualitative, they should see a pattern of decreasing launch height as more and more mass is added to the rocket.

Ask them to explain why this is the case — given a fixed amount of thrust, the distance that a rocket travels decreases as its mass increases.

Ask the children to think of ways, given the same fuel ingredients, to increase the amount of thrust from their film canister rocket motors. They may suggest adding more vinegar and baking soda to the film canister, or different amounts of one of these two ingredients.

16. If time permits, challenge the children to consider altering and testing rocket fuel mixtures while keeping the weight of their rocket constant.

Some variables that they might test include (1) using the same amount of vinegar but altering the amount of baking soda (1/8 teaspoon, 1/4, 1/2, 1, 2, etc.); (2) using the same amount of baking soda, but different amounts of vinegar; (3) pouring the vinegar into the canister over the baking soda; or (4) using different strengths of vinegar.

At some point, adding more baking soda will make no difference. Once the acid-base reaction has produced sufficient gas to pop the top, any further gas production will not contribute to the rocket's motion because the amount of pressure (thrust) needed to pop the top is constant. By starting below the optimal amount of baking soda, children will see an increase in distance traveled as they approach the optimal mix. Once they exceed the optimal mix, they will see no increase in distance traveled.