Making Paper Rockets

Description: Students will construct paper rockets and launch them with a commercially available foot-pump rocket launcher.

TEKS:
6.2.A-E, 6.4.A, 6.8.B, 6.8.D
8.2.A-E, 8.4.A, 8.6.A-C
IPC: 4.A-D
Physics: 2.E-K, 4.A-D

Materials
Paper
Cellophane tape
Scissors
Rulers
Pencils
Rocket forms (short lengths of PVC tubes of the same outer diameter as the launcher (usually 1/2") tube for the rockets –available in 6' or 12' sections at most hardware stores.)
Launcher

> Several commercially available versions are available. The CINDI education team recommends the Stomp Rocket Ultra™ for its ease of use and adjustable launch angle that can be used with projectile motion experiments.

Safety glasses if students will be near the flight path of the rockets.

Time Frame for Paper Rocket Activities

Class-Construction of Rockets: will take from 1/2 hour to 1 hour.

Launching of Rockets: will take about half an hour for a classroom size of 30 students, or longer if multiple launches are allowed.

Optional Calculating the Altitude of the rockets: will take 1/2 hour.

Rocket Construction

Use the directions on the construction sheet for constructing the paper rockets. Have students roll paper around the short lengths of the PCV tube. The tubes serve as forms for constructing the paper rockets. For best performance the paper should be snug on the form but able to slide easily. Make sure students firmly attach the fins and nose cone for their rockets.

> ***Note:*** *Poorly attached nose cones will blow off the rocket leaving the rocket behind or allowing air to escape when trying to build pressure for launch*

Launch Procedures

Follow the instructions for constructing paper rockets. When the rockets are ready follow these instructions for launch:

1. Select a clear area for launch.

2. Set up launcher and orient the angle for the launcher.

   Recommended launch angle is 45 degrees for maximum distance. (The projectile motion interactive simulation from http://phet.colorado.edu/ makes a great virtual lab for students to investigate how launch angle affects distance traveled.

   Aiming paper rockets into the wind is not recommended.

3. Put paper rockets on launch tube.

4. Jump and launch!

   For older students, if minimizing variables, a single student jumper is recommended. For younger students we recommend that each child launch his or her own rocket.

   Multiple trials per rocket recommended if time allows.

5. Measure distances, if desired, prior to retrieving rockets.

6. Determine, in advance, who will fetch the rockets. Do not allow students to retrieve rockets while launches are in progress.

Instructional Ideas for the Teacher:

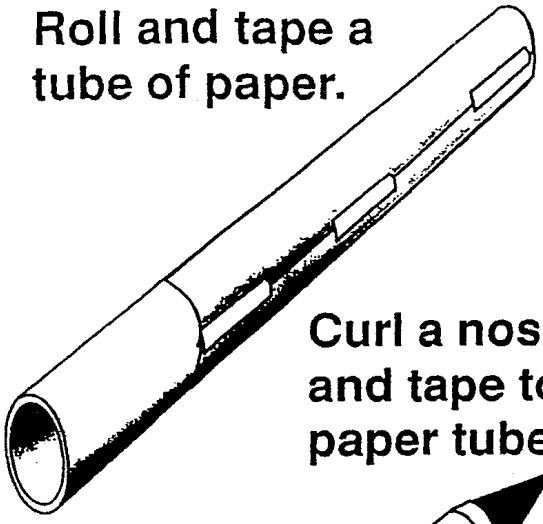
- **Have a rocket design contest.** Even when using the templates, every rocket will be different. Divide your students into groups and give awards for the furthest or highest flight using the same pressure and launch angle.
- **Explore F=ma.** Use different weights of paper and tape, and mass rockets prior to launch.
- **Explore projectile motion.** Have your students determine which launch angle allows the rockets to go the maximum distance (45°).
- **Explore variables.** What makes one rocket out perform another? Do launch conditions (such as wind speed/direction and the direction of launch) matter for the distance traveled or altitude of the rockets?

Important Safety Notice

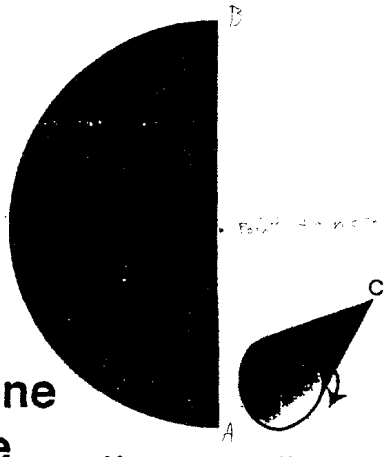
NASA has discontinued use of the PVC Industrial Strength Rocket Launchers. Please use a commercially available launcher.

Making the Rocket

Roll and tape a tube of paper.

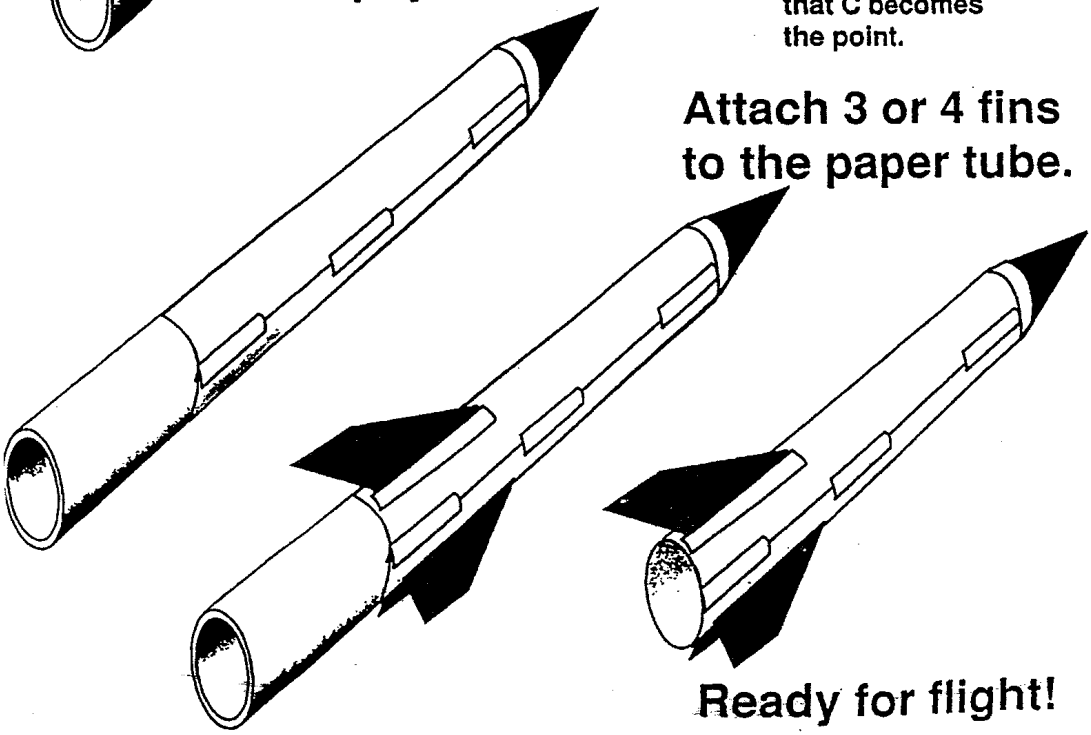


Curl a nose cone and tape to the paper tube.



Nose cone pattern
Curl B under A so that C becomes the point.

Attach 3 or 4 fins to the paper tube.



Ready for flight!

Name _____ Date _____ Period _____

Paper Rocket Lab

Students will construct paper rockets to be launched with an air pressure rocket launcher.

Materials
Paper (copy paper size 8 ½" x 11")
Cellophane tape
Scissors
Rulers
Pencils
Rocket forms (~11" length of 1/2" PVC tubes)
Colored markers (optional)
Safety glasses for the launch (optional)

Question: How will rocket performance differ between rockets that fit tightly or loosely on the launcher?

Write your hypothesis: _____

_____

Procedure
Step 1: Using the Rocket form begin to wrap rocket paper around the tubing. Paper should be snug on the form but able to slide easily off the form.

Step 2: With cellophane tape, tape your paper rocket form.

Step 3: (a) Make a nose cone by drawing a 3" circle and cutting it out or you may use a pattern provided by your teacher.

(b) From outside of circle cut to middle of circle and stop.

(c) Curl B under A so that it becomes the point. Then tape closed from the under part of the curl. Set aside.

Step 4: Cut out using rocket paper 3 fins that may then be taped to the lower part of paper rocket. Make sure you firmly attach fins!

Step 5: Tape nose cone to top of paper rocket. Make sure you firmly attach the nose cone! Name and decorate if time allows.

Step 6: (Optional) Name and decorate your rocket.

Lab Questions

1. Did all the rockets perform the same when launched?

2. To stabilize the rocket, fins were applied. How many are needed to stabilize the rocket?

3. Do the sizes of fins matter?

4. Why does wind affect paper rocket performance?

5. How can mass affect the distance a rocket will fly? (Look at the various rockets made in your classroom, were construction materials used exactly the same way for each rocket?)

6. What would happen if you placed the fins near the nose-cone of the rocket?

7. Write a short lab report describing how your rocket flew. Then draw pictures of your rocket before launching, and after launching.