Making Paper Rockets

Description: Students will construct paper rockets and launch them with a commercially available foot-pump rocket launcher or an industrial strength rocket launcher built by the teacher or a select group of students (such as a science club).

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TEKS:

6.1A-B, 6.2A-E, 6.3A-E, 6.4A-B, 6.6A-C, 6.8A,
7.1A-B, 7.2A-E, 7.3A-E, 7.4A-B, 7.6A-B, 7.8A
8.1A-B, 8.2A-E, 8.3A-E, 8.4A-B, 8.5A-C, 8.7A
IPC: 1.A-B, 2.A-D, 3.A-E, 4.A,

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, and are ideal for younger students. The CINDI education team recommends the Air Power Rocket Extreme Performance ($10.99 at Toys R' Us and Amazon.com in early 2006) for its ease of use and adjustable launch angle that can be used with projectile motion experiments.
- Homemade Industrial strength version should be teacher operated only!

Hand bike pump with gage to check psi or Electric air compressor for industrial strength launcher
Safety glasses

Time Frame for Paper Rocket Activities

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

Launching of Rockets: will take 1 hour for a classroom size of 27 students. It will depend on the classroom size, the type of launcher used, and the number of launches per student.

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. Rocket bodies that are made poorly made may explode into confetti while on launch pad.*

Launch Procedures

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

1. Select a clear area field for launch. Although the rockets are constructed of paper they can still cause injury if they strike someone.

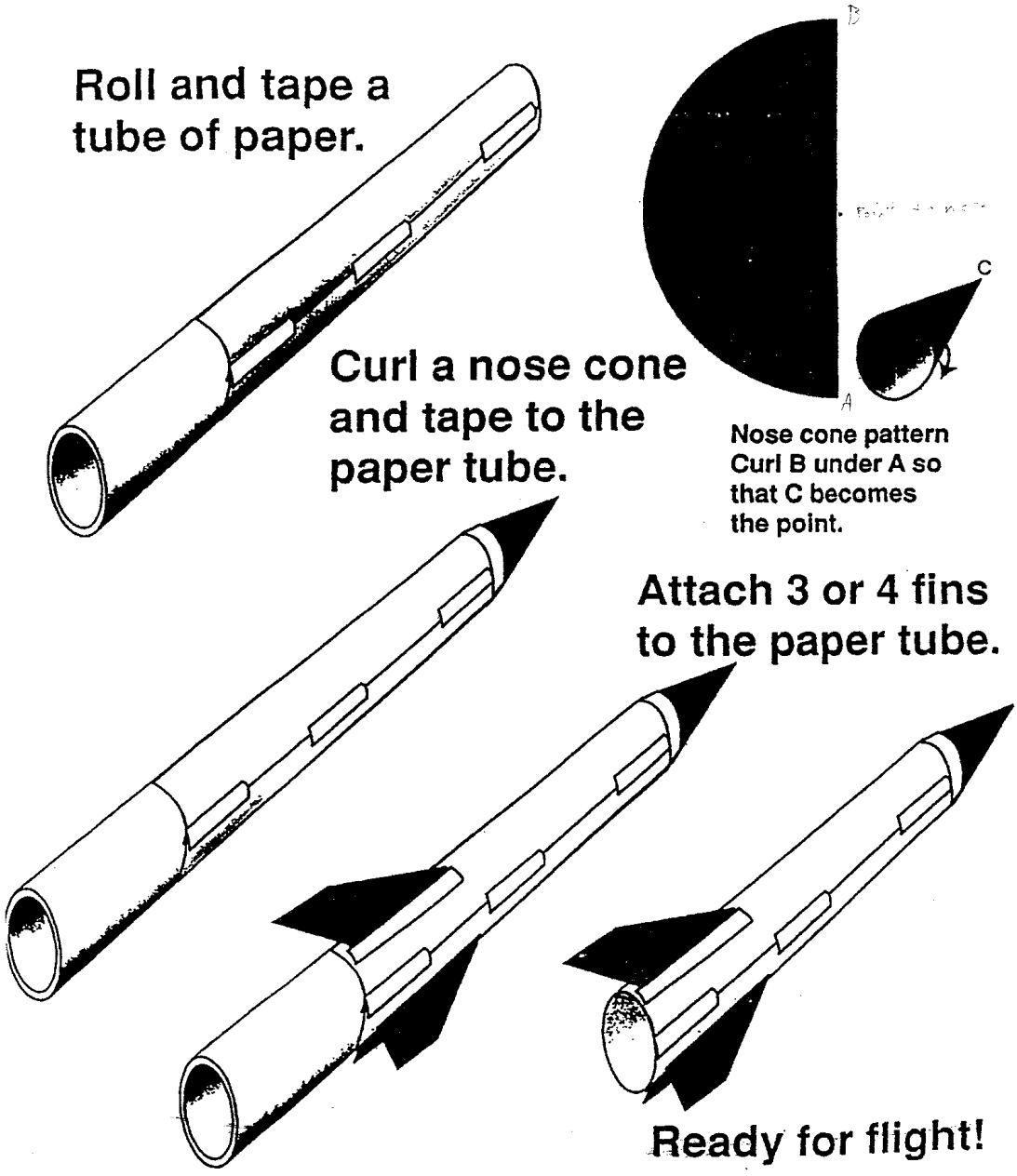
2. Set up the launcher and orient the base so that the launch tube can point straight upward. If the wind is blowing you will want to aim the angle of the tube slightly into the wind.

3. Connect the air compressor or bike pump to the tire valve on the launcher. With the valve closed, pump the launcher up to 30 pounds of pressure. Observe how far the rocket goes and in which direction. Make adjustments to the aiming and pump the launcher to 50 pounds of pressure. Again test fire the rocket and make any final aiming adjustments.

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 projectile motion.** Have your students determine which launch angle allows the rockets to go the maximum distance (45°). One commercial launchers may used for each group of 3-5 students or either type of launcher may be used by the entire class.
- **Explore variables.** What makes one rocket out perform another? Do launch conditions (such as wind speed/direction and the direction of launch) matter?

Making the Rocket



4. Have a student load their rocket on the launch rod. If using industrial strength launcher and/or a high launch angle, students must then clear the launching site. Otherwise students may stand behind the launcher and away from the direction of launch

5. Perform a count down. If you will be determining how high the rocket flies, this allows the trackers know when the rocket is about to launch.

6. Let only the builder of the rocket fetch it after it lands.

Safety Rules

All launches:

- Do not lean over the launch rod at any time.
- Wear eye protection for launches.

When using industrial strength launcher:

- Do not pump the launcher up to a pressure greater than half the rate pressure of the weakest part. The PVC pipes and the valve come with pressure ratings. If the lowest rating is 150 psi, do not pressurize the launcher to greater than 75 psi. This provides a significant safety margin.
- Be careful in handling the launcher. PVC can crack if dropped or struck with sufficient force. Inspect the launcher before use. Discard a launcher that shows signs of cracking.

Tip: Some teachers have reported better flight performance with low-pressure launches (including with the foot-powered commercial launchers) than with high-pressure launches. Aerodynamic drag on the rocket increases with velocity. At higher initial velocities, rocket fins may be distorted leading to even greater drag and diminished performance.
How could students test this theory?

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 11 X 17)
Cellophane tape
Scissors
Rulers
Pencils
Rocket forms (short length of 1/2" PVC tubes)
Colored markers (optional)
Safety glasses for the launch

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 weight affect the distance a rocket will fly? (Look at the various rockets made in your classroom, was specific materials used exactly the same.)

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.

Name_____ Date_____ Period_____

Rocket Report Using the Scientific Method

Building and Launching a Rocket

Using the scientific method build a paper rocket then launch it outside under the direction of your science teacher.

1. Problem: (Question format)

2. Hypothesis: (Your educated guess, using prior knowledge on the subject from Radio, TV, Newspaper, Books, Internet, Class discussions.)

3. Experiment: (Carrying out your experiment using “Steps” to show the order in which you started and completed your experiment.)

4. Observations: (What you observed as following your steps. How the rocket was made and how it performed.)

5. Data: (Collecting information about your rocket from your observations. You may have quantitative and qualitative data here also.)

6. Conclusion: (What were your findings from building to launching your rocket? Did it answer the Problem? How did it follow your hypothesis?)