



Building and Launching a Rocket Model

OBJECTIVES

Students will be able to:

- ★ Indicate the steps in the engineering cycle.
- ★ Work effectively as a team, in pairs, or small groups to design a rocket.
- ★ Analyze how less successful attempts improves the final design.

TIME REQUIRED

One to two 40-minute periods

MATERIALS

Student Activity Sheets (see the last pages of this PDF):

- ★ **Rocket Directions Sheet** and **Rocket Log Sheet** for each student
- ★ **Rocket Pattern 1** copied onto card stock for each team
- ★ **Rocket Pattern 2** copied onto card stock, about four per team

For the Rockets: Glue stick, cellophane tape, scissors, crayons or colored markers, ruler, pennies, and safety glasses for students to wear when throwing their paper rockets

Engineering Process Video:

youtu.be/1u-MiKDo2VI

Note: A more elaborate version of this activity, including the construction of a launcher with PVC pipe can be found at: nasa.gov/pdf/295790main_Rockets_Pop_Rocket_Launcher.pdf

Boost your students' excitement about blasting off into space with Luciana Vega!



Play the Space IQ game as a culminating activity:
Visit scholastic.com/spaceIQ

LESSON STEPS

1. Tell students that in this lesson, they will be making paper rockets and modifying the fins to investigate the best design.
2. Show the class a video from NASA about the engineering process at youtu.be/1u-MiKDo2VI
3. Invite students to review and categorize the steps that engineers use when working on a problem such as this. As needed, guide them through the engineering design process:
 - ★ **Ask** about the problem and how others have attempted to solve it in the past
 - ★ **Imagine** solutions and brainstorming ideas
 - ★ **Plan** including making diagrams and gathering materials
 - ★ **Create** according to the plan
 - ★ **Experiment** and test it out
 - ★ **Improve** the design by determining what worked and what didn't during the test. Then modify the design to make it better.



Be sure to highlight that failures are an expected part of the test phase. Failure is an opportunity to investigate, identify new ideas, and make modifications in order to improve the design.

4. Now on to the paper rockets. Ask students why fins might be important to a rocket's shape. After collecting their ideas, demonstrate how fins work by tossing two rockets (without the pennies) like javelins into the air. One should have fins and one should not. The rocket with fins will sail straight across the room, while the one without will flop or tumble in the air. Have your students describe and explain what happened.
5. Form teams, distribute the four reproducibles, and review directions for building the rockets. Indicate to students that the design changes will have to do with the shape and size of the rocket fins. Tell students they must wear safety glasses when testing their rockets. Give students time to work on, test, and improve their designs.
6. If desired, hold an "air show" to see how well the designs work in practice.
7. Have students complete the reflection portion of the worksheet and discuss as a class.

Building a Better Rocket

Through the power of teamwork, scientists work together to build rockets—and then they launch the rockets all the way into space!

Now you will work in a team to build paper rockets. You will test different designs to find which flies best, just like scientists do.

Before You Start: As a group, decide your team roles. Will each member have a specific job, such as drawing, cutting, taping, or launching? Or will you take turns?

In the book *Luciana* by Erin Teagan, Luciana learned that failure doesn't have to be the end of a dream. **When something doesn't work out the way you hope, investigate why it didn't work and learn from it.** This can help lead to even greater success!

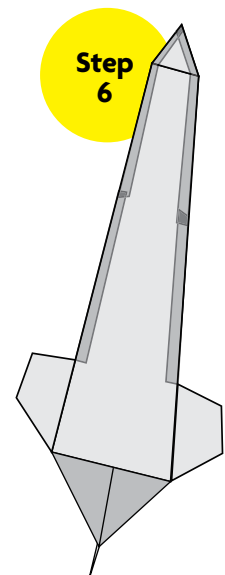
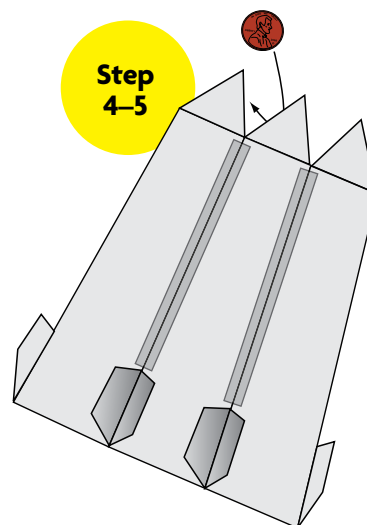


DIRECTIONS

- 1. Decorate:** Begin with the sheet titled **Rocket Pattern 1**. Decorate the rocket.
 - ★ Draw your teammates' faces in the portholes (windows).
 - ★ Together, come up with a team name and write it on your rocket.
- 2. Cut:** Use the solid black lines on the rocket pattern to cut it out. Don't cut the dotted lines.
- 3. Fold:** Fold the fin and nose cones on the dotted lines.
 - ★ To get a straight fold, have one team member press the edge of a ruler to the fold lines while another team member folds the fins outward.
- 4. Add Mass:** Tape a penny securely to the inside of one of the nose cone triangles.
- 5. Tape the Body:** Slide the pieces together and tape up the sides of the rocket body.
 - ★ Do not tape the fins or nose cone pieces yet.
- 6. Make It 3D:** Pick up the rocket. Bring the left and right sides together and tape the seam.
- 7. Set the Fins:** Decide if you want to glue or tape together the fins in sets of two so that you'll

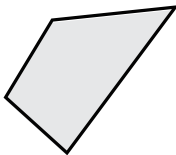
have three fins in total. Or, if you want, leave the fins untaped to have six fins.

- 8. Fly:** Wearing safety goggles, launch your pop rocket, carefully observing its flight. Consider whether there are ways to improve the design to have a more spectacular flight.
- 9. Experiment:** Repeat these steps with the sheets labeled Rocket Pattern 2, but this time, draw in new fin designs before beginning step 1. As a team, try several different shapes, sizes, or placements for the fins. Keep track of your experiment results using the Rocket Log Sheet.



Rocket Log Sheet

Use this sheet with the Rocket Directions Sheet, "Building a Better Rocket," to record the results of your experiment. How does the shape of the fins affect how far or how straight a rocket flies?

FIN DESIGN Draw and/or describe it	RESULT How did your rocket fly?
	

Reflection

1. Does fin design affect how a paper rocket flies? If so, how? Why do you think that is? (Did some types of fins make your rocket fly better, worse, or the same as the original?) _____

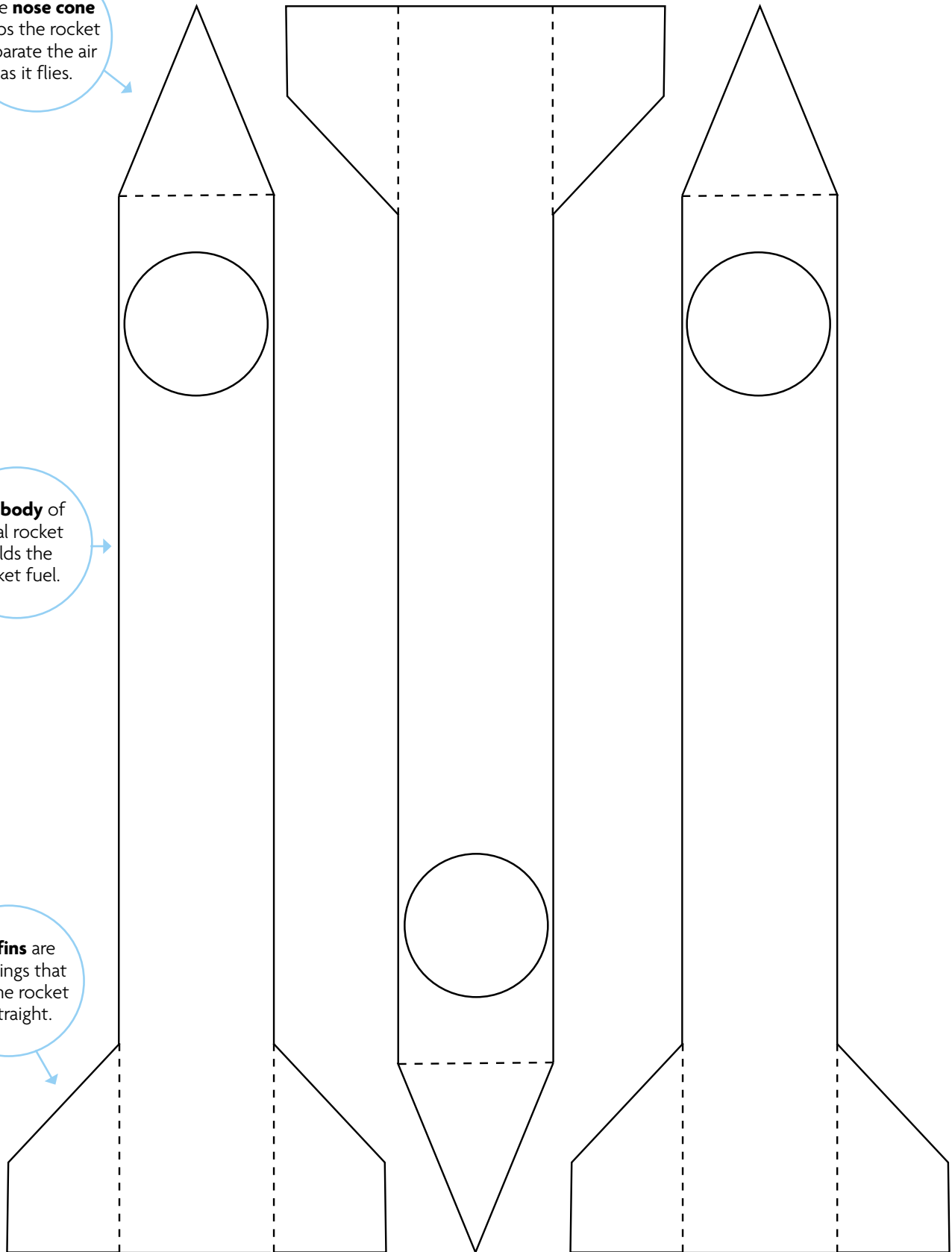
2. What did you learn about using the engineering process? _____

Rocket Pattern 1

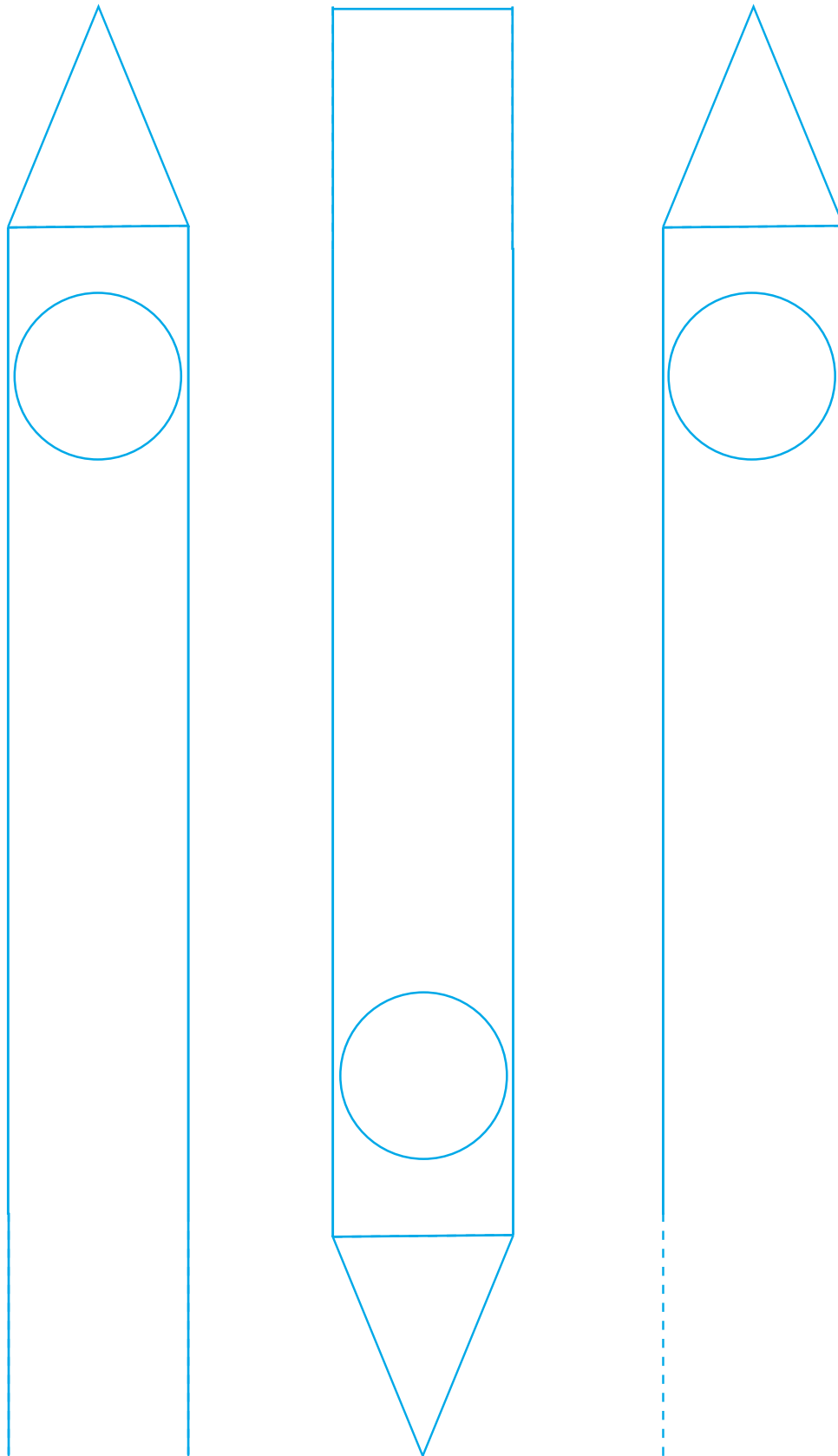
The **nose cone** helps the rocket separate the air as it flies.

The **body** of a real rocket holds the rocket fuel.

The **fins** are tiny wings that help the rocket fly straight.



Rocket Pattern 2



Draw your own **fin** pattern on both sides of all three panels.