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RESOURCE LIBRARY | ACTIVITY : 45 MINS

Pterosaur Glider Experiment

Students alter gliders in controlled experiments to simulate how certain characteristics affect pterosaurs' flight.

GRADES

2 - 5

SUBJECTS

Biology, Geology

CONTENTS

4 Images, 2 Videos, 3 PDFs

OVERVIEW

Students alter gliders in controlled experiments to simulate how certain characteristics affect pterosaurs' flight.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/pterosaur-glider-experiment/>

Program



DIRECTIONS

1. Have students describe pterosaur characteristics.

Show students the video “Flying Monsters: An Introduction.” While they watch, have students write words that come to mind. Ask students to share their words and what they found interesting about these creatures. Students might point out their head shapes or head crests. Explain that certain characteristics of these pterosaurs—in particular their ability to fly—probably helped them survive along with dinosaurs for millions of years. Pterosaurs were the first vertebrates to fly. Over millions of years their flying abilities changed along with the shape of their bodies, including their wings and their head shapes. Explain that these changes over time are called adaptations.

2. Compare powered flight and gliding.

Watch the video in Step 1 one more time, having students think of words to describe pterosaur flight. Students might describe wings flapping fast or slow, or graceful gliding. Ask: *What does gliding look like?* (wings are almost still; pterosaur is soaring) *What does powered flight look like?* (wings are flapping or moving fast) Next, watch the film clip “Quetzalcoatlus.” Ask students to identify the type of flight. Explain that this huge pterosaur glided in the air, and also used powered flight. Explain that in this activity, students will explore how one characteristic of pterosaurs' bodies may have affected their ability to fly.

3. Explore head crests.

Show the Pterosaur Gallery, which includes pictures of the four pterosaurs featured in the film *Flying Monsters 3D: Darwinopterus, Dimorphodon, Tapejara, and Quetzalcoatlus*. Talk about the shapes of the head and head crests. Ask: *How are they similar? How are they different?* Explain that pterosaurs' bodies were altered through time, and these adaptations helped them to survive. Scientists think that their head shapes made a difference in pterosaurs' flying and steering.

4. Prepare for the investigation.

Explain to students that they will test the flight of two gliders. Their objective will be to observe how adding a change like a head crest affects flight. Divide students into groups of three, assigning students the roles of glider thrower, measurer, and recorder. Distribute the Glider Instructions worksheet, and have each group first create Glider 1 and Glider 2 using the

templates. Prepare an area where each group has about 20 feet of space to lay out a straight line of string where they will launch the gliders. Choose a level space and avoid windy locations.

5. Conduct the experiment.

Distribute one set of the worksheets Glider Investigation and Glider Observations per group. Have the recorder read the instructions out loud and use the Glider Observations worksheet to record the observations their group makes. Explain that each thrower should aim to fly the glider along the string, using the same amount of throwing power each time. Ask students to practice several times. Tell them that when they are ready, they should throw the glider in the same way for each of the trials. Have the measurer practice measuring in centimeters the distance from where the glider hits the ground straight to the string, so that the meter stick or tape measure is perpendicular to the string. Have the group follow the instructions to enter their data in the Glider Observations worksheet, tally averages, and summarize descriptions. Let students know that the differences in glider flight may be slight, so they should look carefully for differences.

6. Analyze and discuss the results.

Thinking about the averages and descriptions, have students answer the questions on the Glider Observations worksheet to draw conclusions about the differences in flight performance. Discuss the results as a class, and tally on the board all groups' results. Ask: *Which groups found there was a difference in the two gliders' flight? Which did not? Were there differences in the average measurements, in the descriptions, or both?* Discuss also the need for each group's two gliders to be the same, the throwing style to be the same, and the challenges in making sure this was the case. The head crest needed to be the only variable to make results of the investigation useful. Explain that scientists often repeat trials again and again to identify even the slightest differences or patterns.

7. Make connections with pterosaur study.

Ask students to think about the findings in their experiments. Ask: *Do you think head crests helped pterosaurs fly straighter?* Students can base their conclusions on their groups' results

or the results of the class as a whole. Explain that many paleontologists believe that head shape and head crests did contribute to pterosaurs' improved flying abilities. Paleontologists use models and simulations to help determine these abilities.

Informal Assessment

Check groups' completed observation sheets to make sure students were thorough in their measurement, averaging, and descriptions. If students were able to vary only the head crest while throwing with the same form and intensity each time, students would see that the glider with the crest does fly straighter than the glider without the crest. Students might or might not conclude that having an additional head-crest shape makes a difference in the flight performance, but their conclusion should be based on their observations or the results for the class overall.

Extending the Learning

If possible, show students the film *Flying Monsters 3D*. Have them listen and watch for more information about different pterosaurs' characteristics. Ask them to think about how these pterosaurs adapted, or changed over time, helping them to survive for millions of years. After the film, have them design their own imaginary pterosaur and label three to five of its adaptations.

OBJECTIVES

Subjects & Disciplines

Biology

Earth Science

- Geology

Learning Objectives

Students will:

- compare gliding and powered flight
- compare characteristics of pterosaurs
- create and adapt two glider models, observe flight, and record results
- compare the results of glider tests and draw conclusions about pterosaur adaptations

Teaching Approach

- Learning-for-use

Teaching Methods

- Discovery learning
- Hands-on learning

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Learning and Innovation Skills
 - Communication and Collaboration
 - Creativity and Innovation
- Critical Thinking Skills
 - Applying

National Standards, Principles, and Practices

NATIONAL SCIENCE EDUCATION STANDARDS

- (5-8) Standard A-2:

Understandings about scientific inquiry

- (5-8) Standard B-2:

Motions and forces

- (5-8) Standard C-5:

Diversity and adaptations of organisms

- (K-4) Standard A-2:

Understanding about scientific inquiry

- (K-4) Standard B-2:

Position and motion of objects

- (K-4) Standard C-1:

The characteristics of organisms

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Calculators
- Centimeter tape measure
- Meter sticks
- Pencils
- Scissors
- Transparent tape

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per classroom, Projector, Speakers

PHYSICAL SPACE

- Classroom
- Outdoor recreation space

SETUP

Open space for glider launching

GROUPING

- Large-group instruction

RESOURCES PROVIDED: UNDEFINED

- Flying Monsters: An Introduction
- Flying Monsters: Quetzalcoatlus

RESOURCES PROVIDED: HANDOUTS & WORKSHEETS

- [Glider Instructions](#)
- [Glider Investigation](#)
- [Glider Observations](#)

RESOURCES PROVIDED: IMAGES

- Pterosaur Gallery

BACKGROUND & VOCABULARY

Background Information

The four pterosaurs—*Dimorphodon*, *Darwinopterus*, *Tapejara*, and *Quetzalcoatlus*—lived on Earth from 200 million years ago to 65 million years ago. The earliest of these, *Dimorphodon*, had no head crest and short wings. The latest of these pterosaurs, *Quetzalcoatlus*, had a head crest and very long wingspan, which some estimate was as high as 14 meters (46 feet). The long skull/head crest, and the long wingspan, probably enabled the later pterosaurs to be more effective gliders than the earlier pterosaurs.

Prior Knowledge

[]

Recommended Prior Activities

- None

Vocabulary

| Term | Part of Speech | Definition |
|-------------|----------------|---|
| adaptation | noun | a modification of an organism or its parts that makes it more fit for existence. An adaptation is passed from generation to generation. |
| observation | noun | something that is learned from watching and measuring an object or pattern. |
| variable | noun | piece of data that can change. |

For Further Exploration

Websites

- [National Geographic Entertainment: Flying Monsters 3D](#)



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Glider Investigation

In this experiment, you will observe the difference in flight between a glider with a triangle-shaped head crest and one without the crest. Use the Glider Observations worksheet to record your results.

To set up the experiment, each team of three will need these materials:

- Glider 1 and Glider 2
- Large space to test the gliders
- Tape measure or meter stick
- 20 feet of string or yarn
- Pencil
- Calculator
- Glider Observations worksheet

Team Roles

- Glider thrower
- Measurer
- Recorder

Step 1 Have the recorder read aloud the directions below as the others in your group perform their roles. First, choose a starting point on the floor or ground where your team will throw the glider. The measurer and the thrower then stretch the string from the starting point straight in the direction where the glider will be thrown.

Step 2 From the starting point, the thrower will first throw Glider 1 in the direction of the string. Gently toss the glider and try to make it glide straight along the path of the string. It does not matter how far the glider goes.

Step 3 With the measuring tape or meter stick, measure the distance from where the glider lands on the ground to the string. Measure the shortest distance, so that the measuring tape or meter stick meets the string at a right angle, meaning it will be perpendicular to the string. Record that distance in the chart next to Trial 1. Next, describe how your team saw the glider move this time. Was it wobbly, smooth, or did it dip down fast?

Step 4 Repeat steps 2 and 3 for the next three trials. For best results, be sure to toss the glider with the same movement and strength each time. Measure and describe the gliding each time.

Step 5 Now follow the same steps 2 and 3 for Glider 2. Make sure that you are using the same strength and movement each time.

Step 6 Using a calculator, add the four measurements for Glider 1 and write the total in the first chart. Then divide the totals by 4, and write that number next to Average in the first chart. Then repeat Step 6 for the chart for Glider 2.

Step 7 For both charts, read your descriptions. Answer the question “In what ways were the flight descriptions similar for most of the four trials?”

Step 8 Use the observations recorded in the charts to draw conclusions as you answer the questions.

Name _____

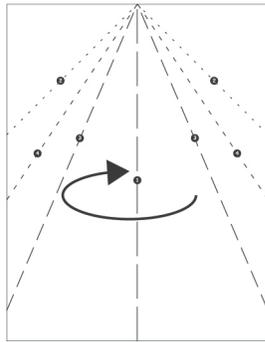
Date _____

Glider Instructions

Follow the steps below to build two gliders using the Glider 1 and Glider 2 templates. To build glider 1, follow Steps A-D and E1. To build glider 2, follow steps A-D and E2.

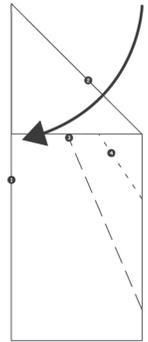
Step A:

Fold the template in half lengthwise along 1.



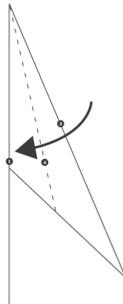
Step B:

Folding along line 2, bring one of the corners toward fold line 1. Make sure the edge lines up with the fold. Fold the opposite corner the same way.



Step C:

Bring line 2 toward line 1, folding along line 3. Repeat with the other side.



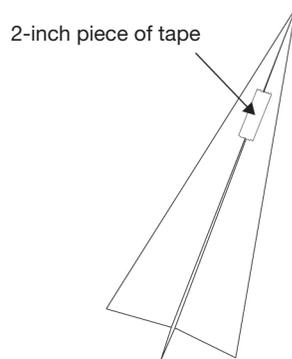
Step D:

Bring line 3 down to line 1, and fold the paper along line 4. Repeat with the other side.



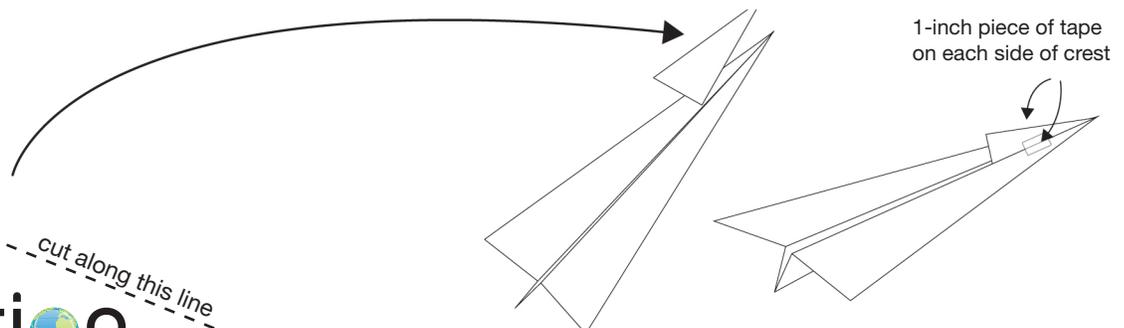
Step E1:

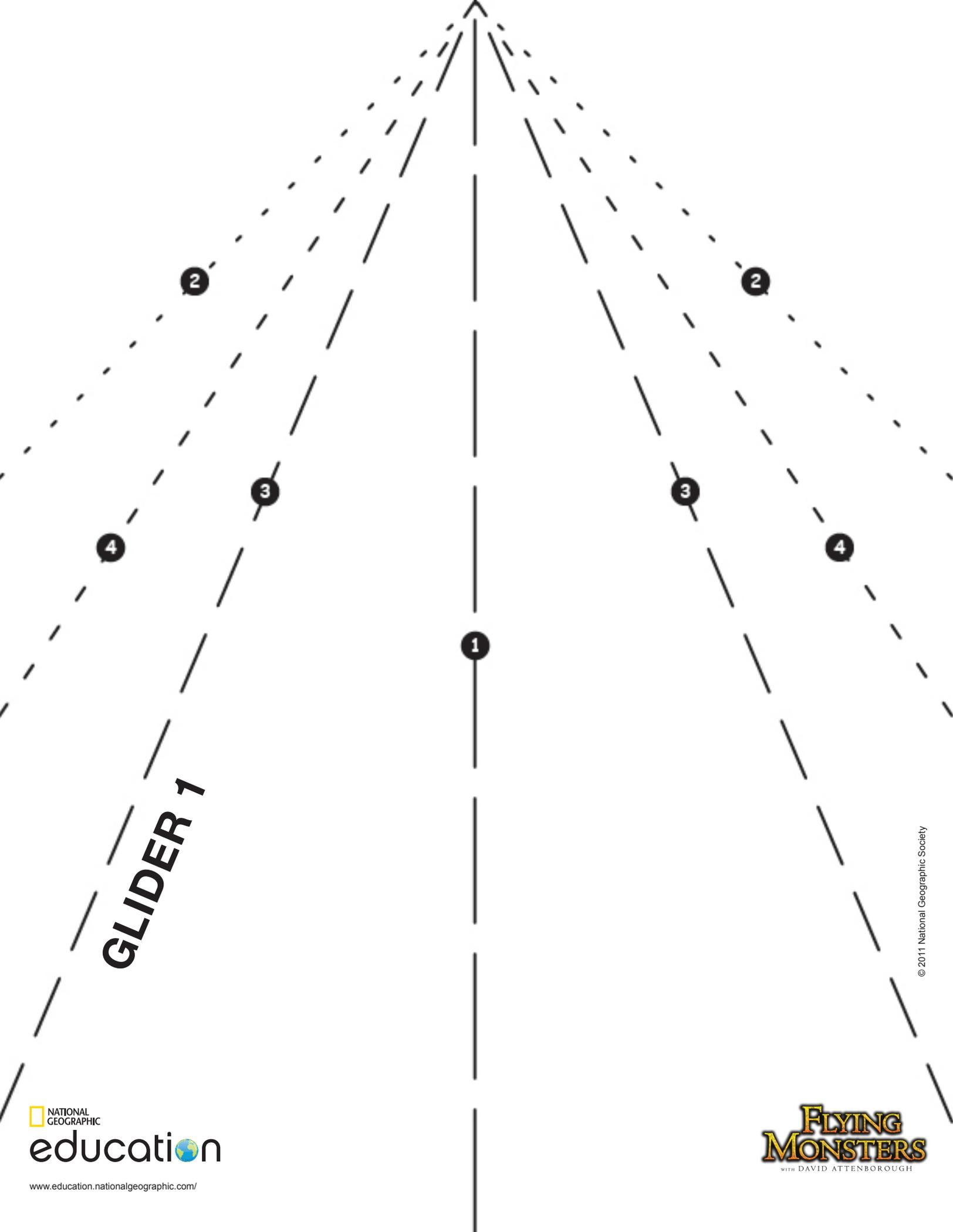
For Glider 1, tape along the top near the point with a 2-inch piece of transparent tape.



Step E2:

For Glider 2, cut the triangle from the corner of this page. Slide the long side of the triangle into the fold of the glider near the point. Tape the triangle to the glider on each side with two 1-inch pieces of tape.





GLIDER 1

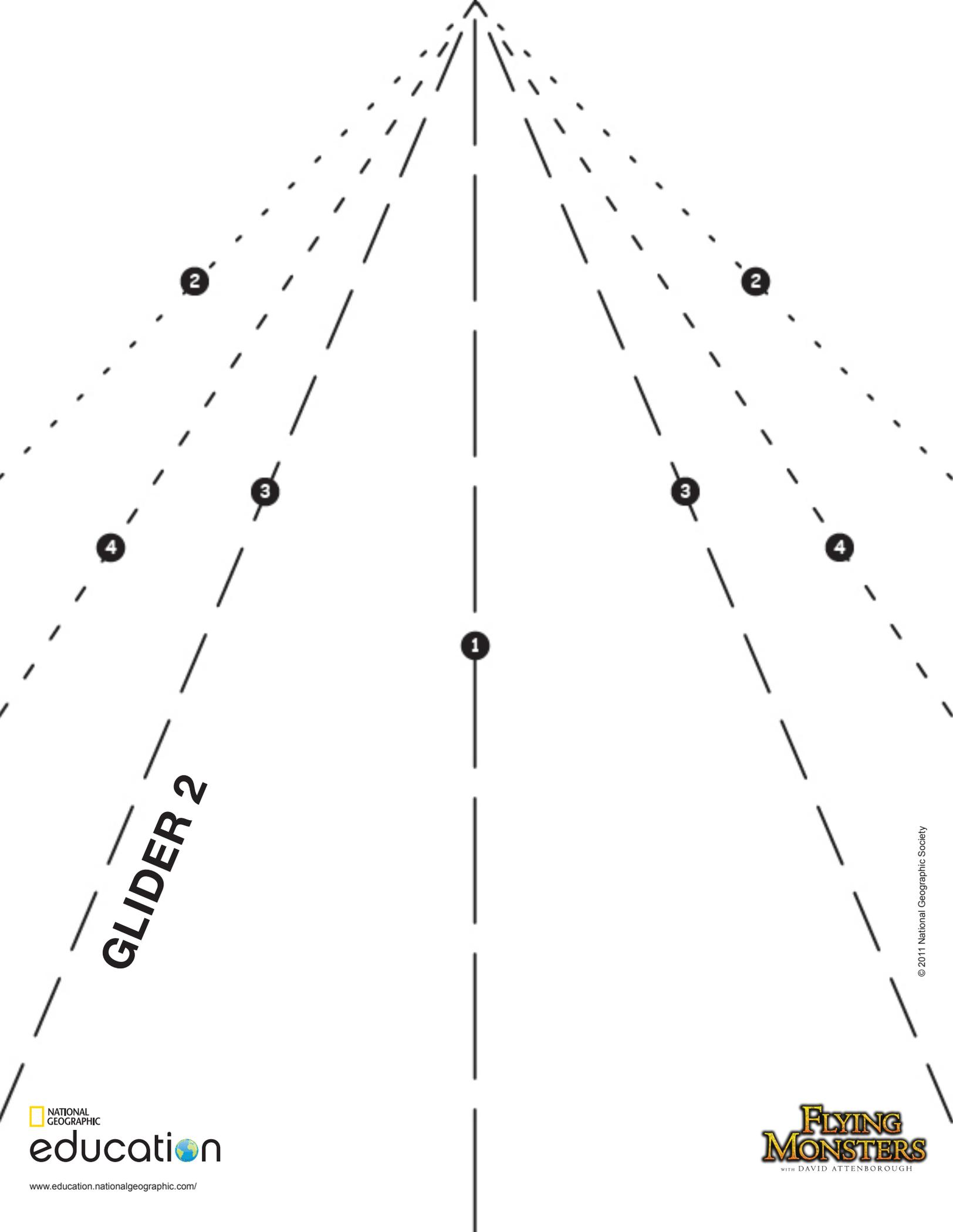


education

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GLIDER 2



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Names _____ Date _____

Glider Observations

Use the charts below to record your observations from the Glider Investigation. Observations can be both measurements and descriptions of what you have seen. Use your observations to help you draw conclusions about head crests.

| GLIDER 1 (without crest) | Distance from string | Description of flight |
|---|-------------------------|--|
| Trial 1 | | |
| Trial 2 | | |
| Trial 3 | | |
| Trial 4 | | |
| Total: (add the 4 measurements) | | In what ways were the flight descriptions similar for most of the four trials? |
| Average: (divide the total by 4) | | |

| GLIDER 2 (with crest) | Distance from string | Description of flight |
|---|-------------------------|--|
| Trial 1 | | |
| Trial 2 | | |
| Trial 3 | | |
| Trial 4 | | |
| Total: (add the 4 measurements) | | In what ways were the flight descriptions similar for most of the four trials? |
| Average: (divide the total by 4) | | |

Draw Conclusions

1. What did you observe about flight of the glider without the crest? _____

2. What did you observe about flight of the glider with the crest? _____

3. Which glider do you think is the better flyer? Give evidence from the experiment to support your opinion. _____
