Wings by Design

Use a bird's flight adaptation to improve a glider.

ZOO.9.8 "Enrichment: Use an engineering design process to utilize a bird's flight adaptations in the development of a flying aircraft (e.g., glider, plane).*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the bird feature the engineers imitate and circle the matching change to their glider. Write 1, 2, and 3 beside the first test, its result, and the revision to trace the design process.

A Hawk-Inspired Glider

1. A wildlife team needs a paper glider to carry a tiny paper sensor across a room without a motor. Engineers begin by defining a goal: the glider must travel at least four meters on each of three launches from a marked line. They notice a soaring hawk holding its broad wings open while circling above a field. Broad wings provide a large area that can generate lift at low speeds. The hawk also spreads its outer flight feathers, leaving narrow gaps near the wingtips. These gaps can reduce energy lost to swirling air at the tips. The team asks which feature a simple glider could imitate.

2. The engineers keep the same body, wingspan, sensor, and paper for two gliders. One has smooth wingtips. On the other, they cut short slits along the outer edge of each wing to imitate the hawk's separated feathers. The slits leave small tabs that can bend upward. Before testing, the team predicts that this design might glide farther, but the cuts could make the tips too flexible. They launch each glider three times from the same line, using the same person and launch motion. They record how far each flight travels before the nose touches the floor.

3. The smooth-wing glider travels 3.3, 3.5, and 3.4 meters. The slotted glider travels 3.8, 4.0, and 4.2 meters. Although the slotted version goes farther in every paired trial, it falls short of four meters once, so it does not yet meet the goal on every launch. The team notices that one thin tab folds sharply after landing. They add a narrow strip of tape at the base of each tab, leaving the gaps open, then repeat the three launches. The revised glider travels 4.1, 4.2, and 4.1 meters. The team keeps the revised design but notes that extra tape adds weight.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which hawk feature did the engineers imitate, and how did they change the glider to imitate it?

2. Why did the engineers keep the body, wingspan, sensor, paper, and launch motion the same during the first comparison?

3. Why did the slotted glider need a revision even though it flew farther than the smooth-wing glider in every paired trial?

4. How did the revision address a problem seen during testing, and what trade-off did it create?

3 YOUR TURN

Your own words

A glider carrying the paper sensor now nose-dives on its first flights. Propose a bird-inspired change other than separated wingtips, then explain how you would compare designs fairly, what you would measure, and when you would revise your design.

ANSWER KEY

Wings by Design

HIGH SCHOOL · ZOO.9.8

PART 1 · READ AND MARK

Underline the bird feature the engineers imitate and circle the matching change to their glider. Write 1, 2, and 3 beside the first test, its result, and the revision to trace the design process. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which hawk feature did the engineers imitate, and how did they change the glider to imitate it?	**They imitated the gaps between the hawk's outer flight feathers by cutting short slits along the glider's wingtips.**
2	Why did the engineers keep the body, wingspan, sensor, paper, and launch motion the same during the first comparison?	**Keeping those conditions the same helped them test whether the wingtip slits affected flight distance.**
3	Why did the slotted glider need a revision even though it flew farther than the smooth-wing glider in every paired trial?	**Its 3.8-meter flight fell short of the four-meter goal, which it had to meet on every launch.**
4	How did the revision address a problem seen during testing, and what trade-off did it create?	**Tape at the base of each tab supported a tab that had folded sharply, but the tape added weight.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would add a small rear flap modeled on a bird's tail feathers and turn its edge slightly upward to help counter the nose dive. I would compare it with an otherwise identical glider that has no flap, using the same sensor, launcher, and launch line. For three launches of each glider, I would measure distance and record whether it landed nose-first. If the new glider still nose-dives or any flight falls short of four meters, I would adjust the flap angle and retest.

Accept other plausible bird-inspired changes if the response connects the adaptation to the nose-dive problem and describes a fair test, a measurable result, and a reason to revise.