# After the Ash

Use a population model to explain natural selection.

**BIO.4** "Students will analyze and interpret evidence to explain the unity and diversity of life. Use models to differentiate between organic and chemical evolution..."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline the environmental change and circle the inherited trait. Put a 1 beside the sentence about unequal survival and a 2 beside the sentence about unequal reproduction.

### A Change in the Beetle Population

1 On a rocky island, a beetle population lives among pale stones. Some beetles have inherited light shells; others have inherited dark shells. In this simplified model, shell color stays the same throughout a beetle's life. Birds hunt beetles by sight. Then ash from a nearby eruption coats the stones, turning the beetles' background dark.

2 After the ash falls, light beetles stand out more than dark beetles. Birds catch more of the visible light beetles, so dark beetles are more likely to survive. The model assumes that no beetles enter or leave the island. A simulation samples 100 beetles before the ash and 100 in each later generation.

**BEETLE SHELL COLORS IN SAMPLES OF 100**

| Sample | Dark shells | Light shells |
|---|---|---|
| Before ash | 20 | 80 |
| Generation 1 after ash | 40 | 60 |
| Generation 3 after ash | 75 | 25 |

3 Survivors can produce more offspring than beetles caught by birds, and offspring usually inherit their parents' shell color. The table shows dark beetles becoming more common over three generations. Ash did not turn any individual beetle dark; instead, inherited colors differed in survival and reproduction. This change in the population over generations is evolution by natural selection.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. How does the sample taken before the ash show that ash did not create dark shells?

2. Why are dark beetles more likely to survive after the ash falls?

3. Use two values from the table to describe how the population changed.

4. Why does this change count as natural selection rather than individual beetles changing color?

## 3 YOUR TURN

Your own words

Suppose rain washes the ash away, exposing pale stones again. Predict how the two shell colors would change over two generations, propose a way to test your prediction in the simulation, and explain the survival and reproduction behind it.

# After the Ash



## PART 1 · READ AND MARK

Underline the environmental change and circle the inherited trait. Put a 1 beside the sentence about unequal survival and a 2 beside the sentence about unequal reproduction. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | How does the sample taken before the ash show that ash did not create dark shells? | **The sample already included 20 dark beetles before the ash fell.** |
| 2 | Why are dark beetles more likely to survive after the ash falls? | **Ash makes the background dark, so birds can see and catch more light beetles.** |
| 3 | Use two values from the table to describe how the population changed. | **Dark beetles increased from 20 in the sample before ash to 75 in the sample from generation 3.** |
| 4 | Why does this change count as natural selection rather than individual beetles changing color? | **Shell color stays the same during a beetle's life. Dark beetles are more likely to survive after the ash and pass their inherited color to offspring, making dark shells more common over generations.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

If pale stones return, light beetles should become more common over two generations, while dark beetles become less common. Birds would spot more dark beetles, so more light beetles would survive and pass on their inherited color. I would run the simulation with pale stones and record each color in samples of 100 beetles at the start and after each of two generations. Rising light counts would support my prediction.

Accept responses that connect the change in background to unequal survival, inherited shell color, and a change in the population over generations. For Your Turn, the test should compare color counts across generations under pale-stone conditions.