TEMPERATURE

House Hunting

Scientists design artificial nests to protect rare African birds

African penguins are less than 2 feet tall. But they have big personalities. They live in large groups and honk loudly at each other. Like people, each penguin has a unique voice.

The penguins live along the southern coast of Africa. They hunt fish in the ocean and lay eggs on land. But the penguins have a big problem. Their environment has been changing. They have no safe place to nest.

A team of scientists wants to help. They're designing artificial nests to protect African penguins. But that's not easy. People have tried building nests before, but the penguins didn't use them. The nests often got too hot.

"Now we're going about it more scientifically," says Kevin Graham. He's a biologist at the Dallas Zoo in Texas who is working on the project.

Poop Problem

African penguins used to make their own nests. They would burrow into a thick layer of bird poop, called guano. The guano came from the penguins and other seabirds. It had built up over hundreds of years.

Guano nests were perfect for penguins. The nests protected them from the hot sun. They also kept out seagulls and other animals that eat penguin eggs.

In the 1860s, however, people began collecting the guano. They used it as fertilizer for farms. By 1900, almost none was left. "It's like if I bulldozed your neighborhood," says Trudi Malan. She studies the penguins in South Africa.

With little guano available, the penguins now lay their eggs in the open. But the birds often get too hot. The parents leave the nest to cool off in the water. Then seagulls can snatch the unattended eggs. That's one reason the African penguin population is at risk.

Testing Nests

Scientists started making artificial nests in 2016. They came up with 15 different designs using various shapes and materials. Each one looked like a little hut.

The scientists needed to choose a design that would be safe for penguins. Most important, it needed to stay cool inside. If the temperature rose above 41° Celsius (106° Fahrenheit), eggs and chicks would die.

Malan helped test the nest designs in South Africa. At first, scientists didn't let any penguins use the nests. They just placed the nests in the sun and measured the temperature inside.

Two nest designs stayed cool enough. The scientists decided to take these to the penguins' habitat. It was time to see how the birds reacted to the nests.

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▲ African penguins like these make nests out of guano, or bird poop. They are endangered in the wild.

PAGES 4-5: THOMAS P. PESCHAK/NATIONAL GEOGRAPHIC CREATIVE (PENGUINS)

Happy Homes

In January 2018, the scientists set up 200 artificial nests in African penguin colonies. They put thermometers inside to measure the temperature. Then they watched to see whether the penguins would lay eggs in them.

After two months, the results were in. The temperatures in the nests never rose above 32°C (90°F). And penguin families had moved into almost every one!

Over the next few years, scientists plan to place 5,000 nests in the penguin colonies. Malan hopes the new nests will help the birds make a comeback. "I think we've got a good shot," she says.

—Katie Peek

Where African Penguins Live

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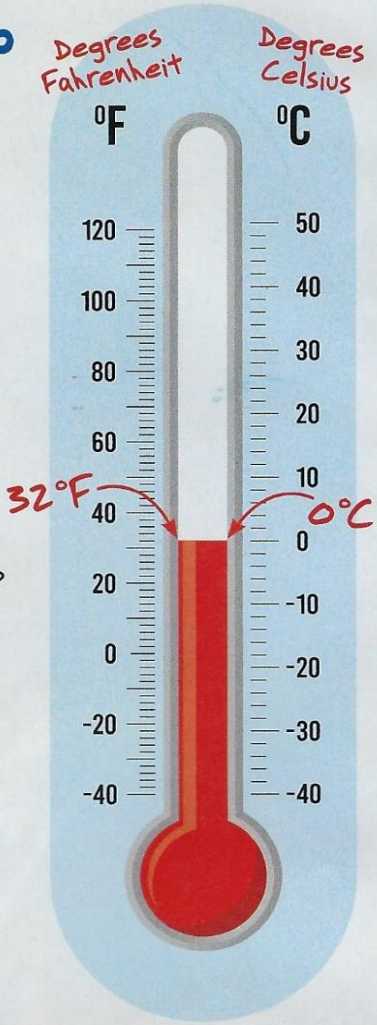
TEMPERATURE

What to Do

Two common units measure temperature: **degrees Fahrenheit (°F)** and **degrees Celsius (°C)**.

EXAMPLE:

What temperature does this thermometer show in °F and °C?



The top of the colored section represents the temperature. The left side shows °F. The right side shows °C. Each mark represents 2 degrees.

So the thermometer shows 32°F, or 0°C.

◀ Scientists tested 15 nest designs before choosing this one.

Now You Try It

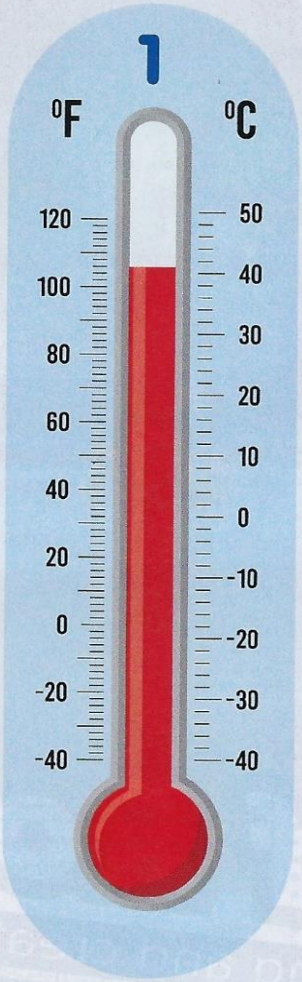
1A. Look at thermometer number 1. This temperature results in dangerous conditions for eggs and chicks. What is the temperature in °C?

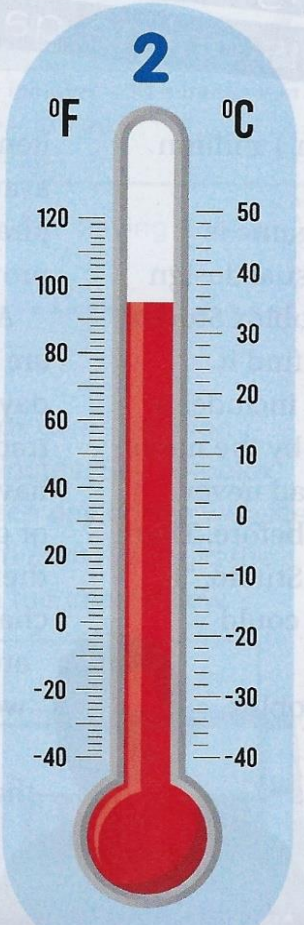
1B. What is the temperature in °F?

2A. Scientists have found a maximum safe temperature for the nests. It's shown on thermometer number 2. What is this temperature in °C and in °F?

2B. Write an equation to show the difference, in °C, between the maximum safe temperature and the dangerous temperature in 1A.

2C. What is this difference in °F? Write an equation.





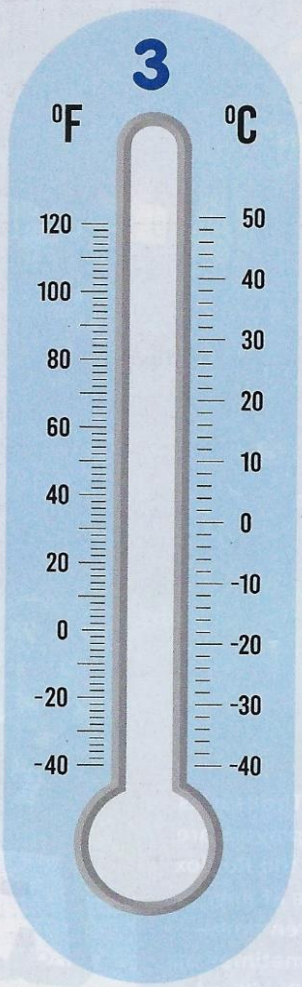
3A. The highest temperature the occupied nests reached during testing was 32°C. Mark this on thermometer number 3.

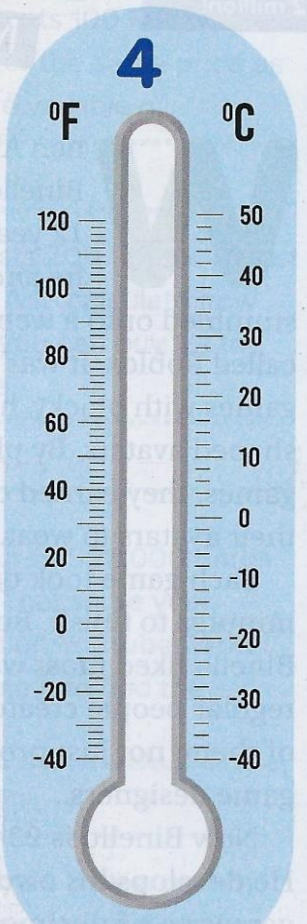
3B. Was this a safe temperature? Explain how you know.

4A. Summer temperatures can reach 97°F in some areas where African penguins live. Mark this on thermometer number 4.

4B. How does the temperature in part A compare with the maximum safe temperature in question 2A? Explain your answer using °F and the thermometer.

4C. Say the temperature is 97°F outside of a nest. The inside of the nest is shaded. Do you think a penguin family would be happier inside or outside the nest? Explain.





MATH TALK Which is a larger change in temperature: an increase of 1°C or 1°F? Talk as a class about how you could answer this question.