Life Without Sunlight

How tools and calculations changed a scientific idea

FSL.1.3 "Identify and communicate the impact of mathematics and technology in the development of scientific thought and the practice of science (e.g., space exploration, the human genome project, and ocean exploration)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two tools, circle two uses of measurements or calculations, and number an earlier scientific expectation 1 and a revised explanation 2.

A Discovery on the Seafloor

1 In 1977, researchers exploring the seafloor near the Galápagos Islands found warm water pouring from cracks in the ocean floor. The site was far below the reach of sunlight, yet clams and other animals crowded around the vents. Earlier, many scientists expected deep-sea ecosystems to depend mainly on food sinking from sunlit waters. A crewed submersible let researchers see the animals in place and collect samples instead of relying only on material hauled up by nets. This new view raised a question: where did the energy supporting such dense life come from?

2 Researchers used instruments to measure temperature and chemicals in water near the vents. The measurements revealed fluids rich in hydrogen sulfide, a chemical that some microbes use as an energy source. Those microbes make organic molecules from carbon dioxide through chemosynthesis, without using sunlight. Scientists compared measurements from vent water with those from surrounding seawater to connect the unusual chemistry to the living community. The submersible's tools did more than locate a strange habitat: they helped scientists test an explanation for how that habitat could support animals. Many vent animals obtain food directly or indirectly from these microbes.

3 A single visit could not show whether one vent field stood for every deep-sea vent. Later expeditions used sonar to map the seafloor and find more possible vent sites. Researchers measured the time between a sound pulse and its returning echo, calculated distances, and used those distances to build maps. They compared temperatures and chemical measurements from multiple sites, looking for patterns rather than treating one dramatic discovery as a rule. Together, mapping, sampling, and numerical comparisons changed a scientific idea: sunlight is not the only starting point for a productive ecosystem.

2 ANSWER WITH EVIDENCE

Use the passage

1. How did the submersible change the evidence researchers could gather and the question they could ask?

2. How did chemical measurements help scientists explain the food supply at the vents?

3. What did researchers measure and calculate with sonar, and how did that help them study more vents?

4. Why was comparing measurements from multiple vent sites more useful than studying one site alone?

3 YOUR TURN

Your own words

A city wants to know whether trees lower pavement temperatures on hot days. In 3 to 4 sentences, propose a technology and a mathematical comparison to test this idea, explain how the results could change a scientific explanation of urban heat, and identify one way to make the comparison fair.

ANSWER KEY # Life Without Sunlight

PART 1 · READ AND MARK

Underline two tools, circle two uses of measurements or calculations, and number an earlier scientific expectation 1 and a revised explanation 2. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How did the submersible change the evidence researchers could gather and the question they could ask?	**It let researchers observe vent animals in place and collect samples. The crowded habitat led them to ask where its energy came from.**
2	How did chemical measurements help scientists explain the food supply at the vents?	**Measurements showed hydrogen sulfide in vent fluids. Some microbes use it for energy and make organic molecules that support vent animals.**
3	What did researchers measure and calculate with sonar, and how did that help them study more vents?	**They measured the time for sound echoes to return and calculated distances. They used the distances to map the seafloor and find possible vent sites.**
4	Why was comparing measurements from multiple vent sites more useful than studying one site alone?	**Comparisons let researchers look for patterns and test whether the explanation applied beyond one unusual site.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would use temperature sensors to record pavement temperatures beside trees and on nearby streets without trees at the same times. I would calculate the average temperature for each group and compare the averages. If pavement beside trees stays cooler, scientists could refine explanations of how trees affect heat in cities. To make the comparison fair, I would measure on the same hot days and use pavement of the same type.

Accept other suitable temperature-measuring tools and mathematical comparisons. The response should connect possible results to a scientific explanation without treating one measurement as conclusive.