Beyond the Naked Eye

How instruments and evidence changed views of the universe

MWH.C.2.4.A "Explain how the scientific method and new technologies, such as the telescope and microscope, led to new theories of the universe."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two telescope observations and one microscope observation, then circle the explanation each observation challenged or supported.

Evidence at Two Scales

1. In the early 1600s, many European scholars accepted an Earth-centered model of the universe. The ancient Greek astronomer Ptolemy had described paths for the Sun, Moon, and planets around Earth. In 1543, Nicolaus Copernicus proposed a Sun-centered model of planetary motion instead, but a proposal needed testing. The scientific method encouraged investigators to compare a model's predictions with observations and to revise explanations when evidence disagreed. New instruments mattered because the naked eye could not reveal every detail. A telescope made distant objects appear larger, giving astronomers observations that could challenge familiar ideas about where Earth belonged.

2. In 1610, Galileo Galilei used a telescope to observe four moons moving around Jupiter. If those moons orbited Jupiter, not every heavenly body circled Earth. Galileo also watched Venus change through a full range of phases, from a thin crescent to a nearly full disk. That pattern fits a Venus that travels around the Sun, but it conflicts with the traditional Ptolemaic arrangement of Venus. These observations challenged an Earth-centered planetary model, though they did not alone prove that Earth moves around the Sun. The telescope supplied evidence; comparing that evidence with competing models made it powerful.

3. Another instrument changed the scale of investigation. In the 1670s, Antonie van Leeuwenhoek used powerful microscopes to report tiny living organisms in water that appeared clear to the naked eye. His reports did not establish which body sits at the center of the planetary system. Instead, they showed that familiar appearances could hide an unseen part of nature, so claims about the physical world needed careful observation. Later, Isaac Newton's 1687 theory of gravity described both falling objects on Earth and the motions of celestial bodies. Together, improved observations and testable mathematical explanations helped replace inherited views with a universe governed by shared physical laws.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why did Copernicus's proposal need observations, rather than just a new explanation?

2. How did Galileo's observation of Jupiter's moons challenge an Earth-centered view?

3. How did the phases of Venus help scientists compare planetary models, and what could they not prove on their own?

4. How did microscope observations and Newton's theory each change scientists' picture of the physical universe?

3 YOUR TURN

Your own words

Imagine a new instrument detects repeated dimming of a distant star. In four sentences, propose two possible explanations, describe one further observation that could help distinguish them, and explain how the result could change a model of planetary systems.

ANSWER KEY

Beyond the Naked Eye

HIGH SCHOOL · MWH.C.2.4.A

PART 1 · READ AND MARK

Underline two telescope observations and one microscope observation, then circle the explanation each observation challenged or supported. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why did Copernicus's proposal need observations, rather than just a new explanation?	**Observations could be compared with the model's predictions to test whether the explanation fit the evidence.**
2	How did Galileo's observation of Jupiter's moons challenge an Earth-centered view?	**The moons orbited Jupiter, showing that not every heavenly body circled Earth.**
3	How did the phases of Venus help scientists compare planetary models, and what could they not prove on their own?	**The full range of phases fit a Venus orbiting the Sun and conflicted with the traditional Ptolemaic arrangement. The phases alone did not prove that Earth orbits the Sun.**
4	How did microscope observations and Newton's theory each change scientists' picture of the physical universe?	**Microscopes revealed living things hidden from the naked eye, showing that appearances could be incomplete. Newton's theory described both falling objects and celestial motion through gravity.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A planet passing in front of the star could cause the dimming. A cloud of dust moving across our view could also block some light. I would check whether the star moves slightly back and forth in a pattern that matches the dimming, as expected if an orbiting planet pulls on it. If it does, the evidence would strengthen a model in which other stars have orbiting planets.

Accept other plausible explanations and tests if the proposed observation could help distinguish between them. Students should connect the possible result to a model of planetary systems without claiming that one observation proves the model.