Clues Across Space

Use observations to test ideas about the universe.

E.6.8.1 "Obtain, evaluate, and summarize past and present theories and evidence to explain the formation and composition of the universe."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each model's claim about the universe's past. Circle the observations that help scientists test those claims.

What Can the Universe Tell Us?

1. Imagine watching dots on a balloon spread apart as the balloon grows. Distant galaxies generally move farther apart, but space itself expands, not a balloon's rubber surface. In the 1920s, astronomers found that light from many distant galaxies is shifted toward red wavelengths. More distant galaxies usually show a larger shift. This pattern suggests that the universe is expanding. If we trace that expansion backward, the observable universe was once much hotter and denser. Scientists call this account of its early history the Big Bang model.

2. A rival idea, called the steady-state model, said the universe has always looked much the same on a large scale. Its supporters proposed that new matter forms as space expands. Then, in 1965, researchers detected faint microwave radiation coming from every direction in space. This cosmic microwave background is leftover light from an early hot stage, stretched to microwave wavelengths as space expanded. The steady-state model did not predict this hot leftover glow. That discovery helped scientists choose the Big Bang model over its rival.

3. The Big Bang model also predicts that early conditions made mostly hydrogen and helium, with a tiny amount of lithium. Measurements of ancient gas clouds find mostly hydrogen and helium, matching that prediction. Hydrogen and helium are the most common kinds of ordinary matter in the universe, though stars later made many heavier elements. However, ordinary matter is only a small part of the universe's total contents. Scientists also infer dark matter from its pull on galaxies and dark energy from the universe's speeding expansion. Their exact nature remains under study.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the Big Bang and steady-state models differ in what they say about the universe's past?

2. Why does the pattern in light from distant galaxies support an expanding universe?

3. Why did the microwave radiation discovery help scientists choose between the two models?

4. How do measurements of ancient gas clouds test a prediction about the universe's composition?

3 YOUR TURN

Your own words

A radio host claims, "The universe has always looked the same, and most ordinary matter is made of heavy elements." Write four sentences correcting the host. Use two different observations to support the model you choose, and explain what ancient gas reveals about composition.

ANSWER KEY

Clues Across Space

GRADE 6 · E.6.8.1

PART 1 · READ AND MARK

Underline each model's claim about the universe's past. Circle the observations that help scientists test those claims. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the Big Bang and steady-state models differ in what they say about the universe's past?	**The Big Bang model says the universe was once hotter and denser. The steady-state model says it has always looked much the same on a large scale.**
2	Why does the pattern in light from distant galaxies support an expanding universe?	**Their light is shifted toward red wavelengths, and more distant galaxies usually show a larger shift. This pattern suggests that space is expanding.**
3	Why did the microwave radiation discovery help scientists choose between the two models?	**The radiation is leftover light from an early hot stage, which fits the Big Bang model. The steady-state model did not predict that glow.**
4	How do measurements of ancient gas clouds test a prediction about the universe's composition?	**The Big Bang model predicts that early conditions made mostly hydrogen and helium. Ancient gas clouds contain mostly those elements, matching the prediction.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The universe has changed, so the steady-state model does not fit the evidence as well as the Big Bang model. Light from distant galaxies shifts toward red, showing that space is expanding. Microwave radiation from every direction fits a hot early universe, not an unchanging one. Ancient gas clouds contain mostly hydrogen and helium, not mostly heavy elements.

Accept explanations that connect observations to the models, even if students use different wording. For Part 3, look for four sentences, two distinct observations, and an accurate statement about hydrogen and helium in ancient gas.