

AoW 10 Directions:

1. Annotate (write your thoughts, questions, etc.) the text (10 points)
2. Identify (circle, underline, highlight, etc.) key words in 1-4. (5 points each question)
3. Circle the BEST answers for 1-4. (10 points each question)
4. In the "Word Parts" chart, write at least 5 words with word parts from the article. Write the word, the word part, the definition of the word part, and the definition (using context clues and word part knowledge.) (5 points for each word)
5. Write a well-written paragraph summary of this text. Your summary must be 5-7 sentences. (10 points)

Astronomers say they found a "Super Earth" beyond dwarf planet Pluto

By Scientific American, adapted by Newsela staff

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The headline "New Planet Found" is about as exciting nowadays as "Dog Bites Man," which is to say, not very.

In the last two decades, astronomers have identified about 2,000 new worlds, thanks largely to the space-based Kepler Mission telescope. These planets orbit stars that lie tens or even hundreds of light-years from Earth — quite a distance given that a single light-year is 6 trillion miles.

Together, these planets are scientifically important, but no single one is likely to be much of a big deal. The new planet announced last week is a very different story, because the world it describes does not circle around a distant star. It is part of our own solar system — a place you would think we had explored pretty well by now.

Evidently not. In a new study, California Institute of Technology planetary scientists Konstantin Batygin and Mike Brown present what they say is strong evidence for a very large undiscovered planet, orbiting in the solar system's outer darkness beyond Pluto.

Call It "Planet Nine"

This new planet could perhaps be 10 times as massive as Earth. The scientists think it is indeed out there, because they have detected abnormalities in the orbits of space objects nearby, which could only be caused by a massive planet. The study will be published in *The Astronomical Journal*, a magazine about astronomy.

"I haven't been this excited about something in quite a while," says Greg Laughlin. He is an expert on planet formation at the University of California, Santa Cruz, and was not involved in the research.

For the time being, the researchers are calling their discovery “Planet Nine.” It comes no closer than 30.5 billion or so kilometers (19 billion miles) from the sun, which is five times farther away than Neptune ever gets to the sun. Despite its enormous size, if it exists, it would be so dim that it’s no surprise nobody has spotted it yet, scientists say.

“Sadly,” Brown says, “we don’t have an actual detection yet.” But the evidence is strong enough that other experts are taking it seriously. “I think it’s pretty convincing,” says Chad Trujillo of the Gemini Observatory in Hawaii.

Batygin and Brown are not the first to argue for an extra planet in our solar system. In 2014, Trujillo and Scott Sheppard, of the Carnegie Institution for Science, argued that there might be something planet-sized out there.

A Huge Unseen World

The theory was based on the orbits of a handful of space objects that seemed to be affected by the gravity of an unseen world.

Brown and Batygin's analysis strengthens their case.

The first thing he and Brown did, Batygin says, was to look at Trujillo and Sheppard's data with entirely fresh eyes.

They noticed that the orbits of the outer solar system objects pointed in the same direction. The shapes of their orbits also lined up. “Shouldn’t something like that be hard to miss?” Brown asks. “Yes, you would think so. This was a case where we had our noses buried in the data, never stepping back and looking at the solar system from above.”

The direction of the orbits was an even stronger hint that something was physically moving these distant objects. “At first,” Brown says, “we said there can’t be a planet out there — that’s crazy.” When they looked at the most likely explanations, nothing fit. When the scientists turned to the “crazy” notion of a planet, however, computer models generated just the right kind of aligned orbits.

The planet that best fits the data would be on the order of 10 times as massive as Earth. It would put the new planet in the so-called “Super Earth” category, which includes many planets around other stars, but none, until now, in our own solar system. It would be smaller than Neptune, the fourth-largest known planet orbiting the sun, which is about 17 times the size of Earth. The new planet's most likely orbit is a highly elongated one that brings it to within 19 billion miles (35 billion kilometers) of the sun at the closest. At its most distant, it would be between three and six times as far away.

But Is It Real?

Even at that enormous distance, Planet Nine could in principle be spotted with existing telescopes. Until they actually see it, astronomers cannot say definitively that Planet Nine is real. "I tend to be very suspicious of claims of an extra planet in the solar system," says Hal Levison of the Southwest Research Institute in Texas. Something is creating the phenomenon, but it needs to be explored further, he adds.

Overall, however, planetary scientists are clearly thrilled by the prospect that we might be on the verge of such a major discovery. "When I was growing up," Sheppard says, "we thought the big planets had all been found. It would be very exciting and very surprising to learn that we were wrong."

The mood of the astronomical community is perfectly captured, Laughlin says, by something British astronomer John Herschel said in 1846. Irregularities had been spotted in the orbit of Uranus, suggesting that the gravity of an unknown, massive planet was tugging on it. Referring to the mystery object, Herschel said, "We see it as Columbus saw America from the shores of Spain." Just two weeks later, Neptune was discovered, right where the astronomers said it should be.

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1. Based on the article, which conclusion is the BEST?
 - a. The possible existence of a new planet is cause for excitement in the scientific community.
 - b. Scientists agree that this new discovery should have been found years ago because of its size.
 - c. Scientists are taking the evidence of a new planet less seriously due to the lack of actual detection.
 - d. The new planet would be put into a "Super Earth" category because of the similarities to Earth.
2. How does the article develop the idea that scientists need to continue research on the solar system?
 - a. by describing new research based on an existing theory
 - b. by mentioning scientific support for the new discovery
 - c. by citing methods for proving the new planet's existence
 - d. by noting the need to be open to new scientific claims

3. Read the sentence from the section "A Huge Unseen World." The first thing he and Brown did, Batygin says, was to look at Trujillo and Sheppard's data with entirely fresh eyes. What does it mean that these scientists looked at the data with "fresh eyes"?
 - a. They looked at the data as if they had never seen it before.
 - b. They gave the data a very intense look. (
 - c. They gave the data a number of looks over time.
 - d. They looked at the data using their own experience.

4. Read the quote from the section "But Is It Real?" "I tend to be very suspicious of claims of an extra planet in the solar system," says Hal Levison of the Southwest Research Institute in Texas. What is the BEST meaning of the word "claims" in the quote?
 - a. achievements
 - b. mandates
 - c. demands
 - d. assertions

Word Parts:

1. _____

2. _____

3. _____

4. _____

5. _____

Summary: